

Understanding Spatial Patterns of Urban Crime in a Developing Country

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Declaration of Authorship

I, Faisal Umar, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

A handwritten signature in blue ink, appearing to read 'Faisal Umar', with a long horizontal stroke extending to the right.

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For my parents and Hafsat,
who have always been dear and near.

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Abstract

Research into spatial patterns of urban crime is not new and the findings of such studies have consistently demonstrated that crime is spatially concentrated. Moreover, the uneven distribution of offences, particularly in the case of property crime (e.g. burglary), is typically found to be correlated with characteristics of both the social and built environment. However, most of the published research to date has been focused on Euro–America cities – little is known about the spatial patterns of urban crime in developing countries such as Nigeria. Consequently, it is unclear if theories derived to explain spatial patterns of urban crime in Euro–American cities have utility for explaining those in developing countries. This research attempts to address this gap.

Primary data were collected using two methods. First, a block environmental inventory (BEI) exercise was conducted to collect data on all 13,687 properties (and the streets on which they were located) in a study area within the city of Kaduna – Nigeria. Second, a crime victimisation survey was conducted for a sample of about one in four properties (N=3,294). The key question this thesis will address is how well can mainstream Euro–American theories of urban crime explain the spatial distribution of crime in the context of developing countries? Specifically, hypotheses were tested regarding (a) whether the “law of crime concentration at place” applies in the context of Nigeria and (b) the utility of the two main theoretical perspectives in environmental criminology, opportunity and social disorganisation, in explaining variations in the rates of urban crime. The results are mixed – supporting premise of such theories in some cases but not in others.

Dissemination of Research Findings

Book Chapter

The following publication is produced from the research findings contained in this thesis:

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Conference Presentations and Proceedings

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F. Umar, J. A. Cheshire, and S. D. Johnson, (2015) Street-Level Crime Mapping in a Developing Country: Insights from Nigeria, *The Association of American Geographers AGM 2015*, 21st – 25th April, 2015, Chicago, USA.

F. Umar, J. A. Cheshire, and S. D. Johnson, (2015) Understanding the spatial pattern of urban crime: a developing country's perspective, *the 23rd Conference on GIS Research UK*, 15th – 17th April, 2015, University of Leeds, Leeds - UK.

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List of Acronyms

BEI – Block Environmental Inventory

B&E – Breaking and Entering

BCS – British Crime Survey

BLR – Binary Logistic Regression

CCTV – Closed-circuit Television

CLEEN – Centre for Law Enforcement Education in Nigeria

CPTED – Crime Prevention through Environmental Design

URP-ABU – Department of Urban and Regional Planning, Ahmadu
Bello University

FRN – Federal Republic of Nigeria

GI – Gini Index

GIS – Geographic Information System

GPS – Global Positioning System

MC – Monte Carlo

MLCN – Max-Lock Consultancy Nigeria

NBC – National Bureau of Statistics of Nigeria

NNA – Nearest Neighbour Analysis

NN1 – Nearest Neighbour Index

NPC – National Population Commission

NPF – Nigerian Police Force

OLS – Ordinary Least Square

SES – Socio-economic status

UK – United Kingdom

URN – Unique reference number

US – United States of America

VGI – Volunteered Geographic Information

VIF – Variance Inflation Factor

Chapter 1

Introduction

Research concerned with spatial patterns of urban crime has consistently demonstrated that it is spatially concentrated. Moreover, the uneven distribution of offences, particularly in the case of property crime (e.g. burglary), is typically found to be correlated with characteristics of both the social and built environment. Theoretical explanations as to why such patterns emerge have evolved along a number of research themes, but of interest to this thesis is the perspective of environmental criminology. This perspective focuses on explaining crime as an event in which its occurrence is influenced by certain situations (see: Wortley and Mazerolle, 2008).

In the last three to four decades, the theoretical frameworks of environmental criminology have guided a substantial volume of research concerned with spatial patterns of urban crime. However, most of the published research to date has focused on crime in Euro–America cities – cities in Western Europe and North America – little is known about the spatial patterns of urban crime in the developing world, particularly countries in sub–Saharan Africa such as Nigeria. In fact, I am aware of no study that has examined spatial patterns of urban crime in Nigeria from the perspectives of environmental criminology. Consequently, it is unclear if the theories derived to explain spatial patterns of urban crime in Euro–American cities have utility for explaining those in developing countries such as Nigeria. This thesis attempts to address this gap by asking:

How well can mainstream Euro–American theories of urban crime explain the spatial distribution of crime in the context of Nigeria?

To address this question, micro–level (primary) data were collected in a study area within the city of Kaduna – Nigeria. The data collection exercise, as will be discussed in Chapter 3, was extensive and was intentionally designed to generate more data than would be required to undertake this PhD project. There were two reasons for

this. First, this ensured that no additional fieldwork would be required in the event of unforeseen changes to the initial idea of the PhD project. The reason for this is twofold – one concerns the (limited) funding available for this PhD project, while the other concerns the distance to the study site (London – Kaduna) which would not permit instant or regular site visits. Second, given that this was the first environmental criminology study of which I am aware that has involved the collection of micro-level primary data on crime in Nigeria, the intention was to maximise the value of the exercise. Therefore, it should be noted at this point that the analyses presented in this thesis do not exhaust the possibilities that the data afford and that future work is planned to use the available data.

The cross-cultural application of Euro-American theories of crime provides an opportunity to test their applicability beyond the context in which they have typically been applied. In contrast to cities in Western Europe and North America, urban areas in contexts such as Nigeria often develop with little or no centralized planning (unregulated development) and may have features that are far less prevalent or even non-existent in typical Euro-American cities. Additionally, the socio-cultural settings in Nigeria differ greatly from Western Europe and North America. These characteristics, combined with extremely sparse spatially referenced crime and

population datasets, make for a challenging environment in which to operationalize the frameworks of the environmental criminology perspective.

In pursuit of the research goal, patterns for two property-based crimes – breaking and entering (B&E) and domestic theft – were analysed in three empirical studies. Both crime types are acts of stealing from a household but B&E requires forceful entry while domestic theft does not. The overarching aims of the thesis were to test (a) whether the “law of crime concentration at place” (Weisburd, 2015) applies in the context of Nigeria and (b) the utility of the two main theoretical perspectives in environmental criminology, opportunity theories (Cohen and Felson, 1979; Brantingham and Brantingham, 1981; Clarke and Cornish, 1985) and social disorganisation theories (Shaw and McKay, 1942; Sampson and Groves, 1989), in explaining variations in the rates of urban crime.

1.1 Thesis Structure

Chapter 2: Theoretical Framework

This chapter sets the theoretical context for the empirical analyses to follow. Specifically, two groups of theories are reviewed – the

social disorganisation and opportunity theories. Conceptually, the former is concerned with how residents of a neighbourhood organize themselves to maintain order in their community while the latter is focused on physical environmental settings and situations that create criminal opportunity structures that facilitate the interaction between offenders and potential targets. The aim is to provide a broad review of the theoretical framework to which these theories contribute, and to provide a clear understanding of how they have informed prior studies of urban crime. This will help situate the work reported in this thesis in the broader literature and inform the hypotheses formulated and tested in subsequent chapters.

Chapter 3: Data and Methods

This chapter presents the primary data collection methodologies utilised in the substantive analysis sections of the thesis. To provide a broader context regarding the study area, the chapter begins with a brief description of the country Nigeria and the city of Kaduna before proceeding to why the study site, Badarawa–Malali urban district, was selected for this PhD project. This is followed by a discussion on the availability (or rather lack) of appropriate data that are of interest to this research and a reflection on the initial ideas that were conceived at the onset of the project regarding data collection. I then describe the data collection methodologies – a field

mapping exercise, a block environmental inventory (BEI), and a household and crime victimisation survey. The fieldwork associated with each approach, as well as, a summary of the data that were collected, is also provided. The chapter concludes with a reflection on the lessons learnt regarding the processes involved in the data collection exercises.

Chapter 4: Crime Concentration at Places

Chapter 4 focuses on testing whether the law of crime concentration at places (Weisburd, 2015) applies in the context of Nigeria. The law states that *“for a defined measure of crime at a specific microgeographic unit, the concentration of crime will fall within a narrow bandwidth of percentages for a defined cumulative proportion of crime”* (p.138). Using data from the BEI and crime victimisation surveys, the distribution of crimes at individual households, street segments and neighbourhoods are analysed. At the household level, hypotheses are tested regarding whether crime is spatially clustered more than would be expected by chance. Further hypotheses are tested regarding whether crime concentrates at different spatial scales (street segments and neighbourhoods), and if such clustering reflects anything beyond the pattern observed at lower levels of resolution (e.g. the household or point level). The

findings are presented and discussed against the backdrop of the existing literature on the concentration of crime at places.

Chapter 5: Testing Theories of Social Disorganisation in Nigeria¹

In this chapter, the social disorganization approach to explaining variation in area level rates of crime is applied in the context of Nigeria. Socio-cultural differences between settings of Nigeria and Euro-American countries are considered in terms of the likely utility of such theories and how they might be tested. The chapter begins by recapitulating the premise of social disorganization theory and the lack of research in the developing world. This is followed by a review of the different components of social disorganization theory, the mechanisms through which they are believed to operate, how they have been estimated in previous studies, and whether they are meaningful in the context of Nigeria. A brief description of the data and the geographical units of analysis used in this chapter are then presented. What follows is an empirical test of social disorganization theory using the primary data collected in Nigeria. The final section discusses the challenges associated with conducting such research in

¹ This chapter has been published in the Oxford Handbook of Environmental Criminology in collaboration with Shane D. Johnson and James A. Cheshire. Please see Section: Dissemination of Research Findings

developing countries, the findings, and their implications for criminological understanding.

Chapter 6: Opportunity Theories and the Risk of Victimisation

Considering the frameworks of opportunity theories, this chapter examines the variation in the risk of victimisation across individual households. Specifically, the structural choice approach (Miethe and Meier, 1990) is employed in the examination of various situational aspects that influence the crime opportunity structure. The chapter is structured in a format similar to Chapter 5. It begins with a brief discussion of opportunity theories of crime – Routine Activity Theory (Cohen and Felson, 1979), Crime Pattern Theory (Brantingham and Brantingham, 1981) and the Rational Choice Perspective (Clarke and Cornish, 1985). This is followed by a discussion of four situational aspects that are believed to influence crime opportunity structure – the proximity to crime, exposure to crime, target attractiveness and guardianship – the mechanisms through which they are assumed to operate, and how they were being estimated in prior studies. Taking into account the local conditions of the study settings, the section that follows describes how each of the variables considered in the analyses were measured and which component of the opportunity structure for crime they were intended to estimate. The findings are presented and discussed against the backdrop of

the existing literature and what such findings mean for future research.

Chapter 7: General Discussion and Conclusion

A detailed discussion is provided at the end of each empirical chapter. The aim of this final chapter is to thus draw together all of the findings and to discuss what they mean for theory and crime prevention and control. It begins by summarising the findings from each case study and evaluates the extent to which Euro–American theories can explain patterns of urban crime in Nigeria. The implication of each finding to theory and practice is discussed followed by a discussion of the limitations of the research and avenues for future work.

Chapter 2

Theoretical Framework

Empirical evidence continues to demonstrate that urban crime concentrates spatially (Sherman et al., 1989; Weisburd et al., 2004; Johnson, 2010). Moreover, empirical research (reviewed below) suggests that the distribution of offences typically correlates with characteristics of both the social and built environment. Previous research has sought to understand the influence of the immediate environment on crime and to provide theoretical explanations as to the processes that produce them. Two theoretical perspectives are dominant in this context – the social disorganisation and opportunity theories perspectives. On the one hand, theories of social disorganisation pursue the link between rates of crime across urban neighbourhoods and social conditions of communities. On the

other, the perspective of opportunity theories seeks to focus on how physical environmental settings and situations that create criminal opportunity structure which facilitate the interaction between an offender and a potential target.

The perspectives of social disorganisation and opportunity theories have guided a substantial volume of criminological research. However, much of this research takes place in Euro–American cities with little or no attention given to cities in developing countries particularly those in sub–Saharan Africa. It is against this backdrop that this thesis seeks to explore whether the mainstream Euro–American theories of urban crime can be relied upon in explaining the spatial patterns of crime in developing countries such as Nigeria.

This chapter sets the theoretical context for the empirical analyses that follow. The hypotheses to be tested in this thesis are concerned with the law of crime concentration at place; theories of social disorganisation; and the opportunity theories. It is important, therefore, to provide a broad review of the theoretical framework in which these theories operate, and also to have a clear understanding of how they have informed prior studies of urban crime. The aim is to formulate and strengthen key research questions and hypotheses, identify the appropriate variables for analysis and evaluation, and

design an appropriate research methodology. The review begins with a general overview of research trends concerned with spatial patterns of crime and the urban environment. This is to provide a background into the evolution of the theories that are of concern to this thesis and to also highlight the turning points that have reshaped how scholars have studied urban crime problems.

The section that follows reviews the theoretical underpinning of the social disorganisation theory. It is important, however, to note that a lengthy discussion of the theoretical mechanisms is intentionally avoided, leaving that discussion until Chapter 5. This is to allow for a more detailed discussion of the evolution and conceptual issues that have defined the development of social disorganisation theory. The section that follows considers the perspective of the opportunity theories, a perspective which is further discussed under two different themes, the first focuses on how crime events occur, while the second considers how this perspective has informed crime control and prevention. Finally, the conclusion section provides a recap on the focus of both the theoretical and empirical studies reviewed in this chapter. It also highlights the dearth of research concerning spatial patterns of urban crime in developing countries.

2.1 Crime and the Urban Environment

As far back as the 19th century, European scholars have shown a keen interest in the study of spatial patterns of crime. In their review, Weisburd et al., (2009) reported a number of classical studies conducted in the 1800s that were foundational to the study of the spatial patterns of crime². Although these works provided the motivations for what followed, much of the theoretical development and empirical research that defined the field did not emerge until the early 20th century, becoming particularly prominent in the 1920's with scholars at the University of Chicago (also known as the Chicago School) leading the way. An important turning point was the shift in focus – from an offender-centric based study of urban crime problems to one that considered how the composition of the environment influenced crime and criminality. For instance, the study of delinquency areas in the city of Chicago by Clifford Shaw and colleagues in 1929 presents in detail for the first time in America, a fascinating relationship between rates of crime and neighbourhood characteristics (explored in more detail in the next section). It is regarded as a landmark in the study of urban crime (Weisburd et al., 2009) with Andresen (2006) suggesting that the

² These include the works of Balbi and Guerry (1829); Ducpetiaux (1827); Quetelet (1831); Greg (1839); Rawson (1839); Fletcher (1850); Glydes (1856); Mayhew (1851); Lombroso (1878); and that of Tarde (1890).

contemporary study of spatial patterns of urban crime originates from this work.

The early attempts to explain patterns of crime, including the classical works of the Chicago school tended to conceptualize the occurrence of crime from the perspective of social trends. Often efforts involved exploring correlations between rates of crime in urban areas and factors that define the social fabric of an environment. Understanding the urban crime problem in this context alone tends to ignore the influences of other non-social factors and situations that may provide the favourable conditions for crime to occur (Clarke, 1983).

To recognise the influence of non-social factors in understanding the urban crime problem, there have been a number of arguments developed over the last three decades. This arose from the viewpoint that crime is an event which is better understood when all the elements that make it possible to occur are being considered. This includes the offender, victim, place and time effect, or any other situation that will perhaps allow an offender to target a victim. Opportunity theories of crime evolved along this line of thought. As will be discussed in more detail below, the perspective of opportunity theories is a holistic one to understanding the urban crime problem,

and it also provides the foundation for an effective formulation of crime prevention and control strategies.

2.2 Social Disorganisation Theory

The idea that residents of an organized community would work together to maintain order emanates from the work of the French sociologist David Émile Durkheim in the 1890s. Durkheim (1893 [1984]) argued that shared beliefs, which he refers to as *collective conscience*, play a vital role in unifying a society towards achieving common good – thus, order is maintained in such society. Social disorganisation theory (Shaw and McKay, 1942; 1969) stems from this perspective. Conceptually, it is about how residents of a neighbourhood organize themselves to maintain order in their community. The theory evolved from the work of Clifford Shaw and Henry McKay in their 1942 book entitled ‘*Juvenile Delinquency and Urban Areas*’. It is a meso–level theory of crime that attempts to explain between–area variations in rates of crime across urban neighbourhoods.

Shaw and McKay (1942, 1969) examine the rates of juvenile delinquency across urban neighbourhoods in the city of Chicago and

found out that, not only did delinquency cluster in particular areas; the concentration was higher at the less popular transitional zone of the city – neighbourhoods that are characterized by a population that is instable, ethnically diverse, and lower in socio-economic status. To explain this pattern, Shaw and McKay (1942; 1969) made three assumptions – population instability disrupts the social network of a community – members of a heterogenous community are less likely to be able to communicate effectively with one another, or to share common goals and normative values about what types of behaviour are and are not appropriate – and, residents of lower SES neighbourhoods had little investment or the resources to change their surroundings but would aim to do so as soon as they have the ability. Putting these assumptions together, Shaw and McKay (1942; 1969) argued that a community's social organisation is disrupted as a result of these three conditions, and the ability of residents to supervise and control the behaviour of juveniles is weakened, and, thus, leads to higher rates of crime and delinquency. An elaborate discussion on the mechanism(s) through which these exogenous sources of community social disorganisation are assumed to impact upon crime, how they have been estimated in prior studies, and whether they are meaningful in the context of this thesis are provided in Chapter 5.

The perspective of social disorganisation theory has occupied a high position in criminological thinking, and arguably, regarded as one of the most influential approaches to the study of urban crime and social disorder (Bursik, 1988). It has brought a fundamental change in the approach to the study of crime and delinquency (Ackerman and Murray, 2004). The theory does not see the rate of urban crime and delinquency from the viewpoint of an individual's behavioural patterns, which had been the conventional approach of criminologists to understanding urban crime problem at the time. Instead, the rate of crime and delinquency in an area was seen to be a reflection of a community's level of social (dis)organisation. This was an important turning point that would have significant implications for crime prevention strategies. For instance, the objective of crime prevention policies would focus on changing the environment that breeds criminality instead of altering the behaviour of offenders.

However, while social disorganisation theory attracted considerable academic interest in the early stage of its development, interest declined from the 1950's through to the 1970's because scholars could not substantiate the validity of Shaw and McKay's works. This is not surprising considering the lack of appropriate data (Sampson and Groves, 1989) and also the primordial methods of data analysis

at the time (Kubrin and Wo, 2016). The period beginning in the 1980's saw a wave of renewed interest that resulted in the refinement and extension of the theory to include some features that were not envisioned in the original conception of the social disorganisation theory (Bursik, 1988; Tittle, 2000).

For instance, Sampson and Groves (1989) built on Shaw and McKay's (1969) model to extend the theory of social disorganisation. They argue that, in addition to population instability, ethnic diversity, and SES as assumed by Shaw and McKay (1969), family disruption and urbanization are also other exogenous sources of community social (dis)organisation. The assumption is that, regarding the effect of family disruption, two-parent households provide increased supervision and guardianship not only to their children but also to others in the larger community (compared to a disrupted family with single-parent). The level of urbanization, as a source of social disorganisation, is assumed to weaken local friendship networks in a community that leads to lack of social participation in local affairs (Sampson and Groves, 1989: p.781–2). Using data from the British Crime Survey (BCS) to test the extended model, Sampson and Groves (1989) provide support for the social disorganisation theory – that between-community variations in the rate of offending and victimisation is much accounted for by

the variation in level of community social disorganisation. While some studies have further provided additional evidence (e.g. Veysey and Messner 1999; Lowenkamp et al., 2003), others could only offer a partial support for the premise of social disorganisation theory (e.g. Sun et al., 2004; Bruinsma et al., 2013), a point to which I will return in Chapter 5.

Over the years, the perspective of social disorganisation theory has faced many challenges and criticisms (Bursik, 1988; Kubrin & Weitzer, 2003; Kubrin and Wo, 2016). While some have been fully, or at least partly resolved, others still linger (Kubrin, 2009). For instance, Sampson and Groves (1989) have addressed the long standing criticism around study design and how to empirically test the premise of social disorganisation theory. However, the definition of neighbourhood is yet to be resolved – there is inconsistency throughout the social disorganisation literature on what a neighbourhood really is. As scholars continue to further research around the effects of community's social (dis)organisation and how this explains variations in urban crime across neighbourhoods, other perspectives have emanated from the premise of this theory.

More recently, Sampson et al. (1997) developed the concept of collective efficacy, defined as social cohesion among neighbours

which influences the willingness of one to act on behalf of others for collective benefit. In their paper, Sampson and colleagues examined the association between levels of collective efficacy – estimated using a scale that includes 5 questions that each measure social cohesion and informal social control at the neighbourhood level and rates of violent criminal behaviours across neighbourhoods. Their findings suggest that neighbourhoods with higher levels of collective efficacy tended to experience lower rates of violent crimes. Further empirical studies (e.g. Morenoff et al. 2001; Gibson et al. 2002) provide further support for this theory. However, while they confirmed it may be an important factor that helps explain variation in *violent* crime between neighbourhoods, Maxwell et al., (2011) did not find evidence to suggest an association between levels of collective efficacy and rates of *property* crimes in the city of Chicago. This highlights some of the potential limitations of the theory that could be addressed in further research.

2.3 Opportunity Theories

Two theoretical frameworks are of interest to this thesis. As discussed, the social disorganisation perspective sees variation in rates of crime across urban neighbourhoods as a consequence of community social structure. This perspective focuses on meso-level

of place (e.g. neighbourhood) as unit of analysis. The other perspective, opportunity theories, focuses on the influence of the physical environment. Consequently, this perspective is more concerned with the immediate environment (micro-level of place e.g. household or street segment) and the situation in which crime events take place. The last four decades have seen a significant shift of research interest from the traditional criminological approach³ to the perspective of opportunity theories. This approach is a more holistic one which pays attention to the situation that makes it possible for crime events to occur.

What opportunity theories share in common that social disorganisation does not, is that they focus on crime events. Social disorganisation theory is less vocal on why a crime might occur when it does – it focuses only on explaining social processes that influence the ability of a community to exert informal social control. In contrast, to explain criminality from the perspective of opportunity theories, it requires an understanding of the configuration of both the physical and the social environment, and knowledge of how this might provide the opportunity for crime.

³ Traditional approach in this context refers to the criminological approach that seeks to explain how people become criminals. This perspective contrasts sharply with the idea of environmental criminology which is more concerned with the situation that provides the criminal offender with the opportunity to offend.

Many theories have emerged in this regard, and as will be discussed, has helped in advancing our understanding of how crime events occur.

The core theoretical development of opportunity theories includes a number of themes – for instance, *Routine Activity Theory* (Cohen and Felson, 1979) and *Crime Pattern Theory* (Brantingham and Brantingham, 1981) focused on explaining crime events from the viewpoint of lifestyle and environmental influences while the *Rational Choice Perspective* (Cornish & Clarke, 1986) is more interested with what informs offender decision-making, particularly (but not exclusively) at the event level. Lopez and van Nes (2007) suggest that these are the “*most influential contemporary theories in environmental criminology*”. Other perspectives such as *defensible space* (Newman, 1973) or *crime prevention through environmental design* (Jeffery, 1971); and *situational crime prevention* (Clarke, 1980) have also provided ideas and conceptual frameworks on how to prevent crime. As each of these will be discussed here, explanations as to why, when and where crimes are more likely to occur have continued to emerge.

Rational Choice Perspective

The rational choice perspective is actually a “*heuristic device or conceptual tool rather than a conventional criminology theory*” (Cornish and Clarke, 2008 p.24). This conceptual tool focuses on explaining the process of an offender’s decision-making. The perspective was originally developed as an economic theory, also known as choice or rational action theory, applied in modelling an individual’s decision-making process. The original theory assumes that all individuals weigh the possible cost of their action against potential gains, and act rationally when deciding on whether to take a particular course of action or not. This perspective has been applied to the study of social and economic behaviour of individuals and has found applications in many fields of social sciences including criminology. The spread of rational choice theory across all social science disciplines was overwhelming in the 1980’s (Akers, 1990).

Ron Clarke and Derek Cornish introduced the concept of rational choice, as it is known today, into criminology in the 1980’s (see Clarke and Cornish, 1985; Cornish and Clarke, 1986). It is important, although, to note that research on how and why criminals act rationally predates this period – Brantingham and

Brantingham (1993a) have reported a number of such works⁴. Other classical examples are works of Cesare Beccaria and that of Jeremy Bentham in the 18th century (see: Onwudiwe et al., 2004). While theorizing the idea of rational choice in the field of criminology has been at “*a consistent pace*” for some time, it is important to also note that prior to 1970’s however, this idea was ‘*in disrepute among criminologists*’ (Tittle, 2000).

The rational choice perspective (Clarke and Cornish, 1985; Cornish and Clarke, 1986; Cornish and Clarke, 2008) suggests that, criminal decision-making depends on the offender’s perception with regards to the possible cost and potential gains of committing a crime. A potential gain is perceived as any benefit that resulted from committing a crime. This could be in material form such as proceeds from a bank robbery, or for personal satisfaction such as vandalism for the purpose of revenge. The cost of offending could be viewed in different ways, for example as any risk of being caught, the amount of time or physical effort needed to commit a crime or the possible financial cost incurred in the process of committing a crime.

⁴ “... The work of Lynch (1960, 1976, 1981), Orleans (1973), Downs (1981), Evans and Pezdek (1980), Gärling et al. (1984), Golledge (1987), Gärling (1989), and Aitken and Prosser (1990) all suggest interesting research on criminal behavior and decisions made when committing a crime.” - Brantingham and Brantingham (1993b: p15)

Some costs may be associated with potential consequences, such as formal (e.g. prison) or informal punishments (e.g. bringing shame to the offender), should they be caught. This has become known in the literature as the deterrent–effect. While fear of being punished is widely perceived to have significant deterrent–effect on criminal decision–making (Nagin and Paternoster, 1993; Liska and Messner, 1999), it is important, however, to note that the extent to which this discourages offending remains contested (Onwudiwe et al., 2004; Nagin, 2013). In fact, research concerning this is not always supportive of such an assumption (Wright et al., 2004). Moreover, supporting empirical evidence is considered weak due to the fact that it is very difficult to measure deterrent–effect (Paternoster, 2010; Onwudiwe et al., 2004).

Overall, the rational choice perspective attempts to explain an individual’s decision making with respect to choices presented by criminal opportunities. The decision to commit a crime is a product of an offender’s perception of the attractiveness of the target, as well as, the level of risk associated with committing such crime (Nagin and Paternoster, 1993). Although the development of rational choice perspective is still a work in progress (Clarke, 2008), the concept has guided much research concerning the process of criminal behaviour (see for example: Rossmo, 2000; Wortley and Smallbone, 2006).

It is important, however, to note that offenders do not always act rationally (Wright et al., 2004), some may ignore consequences that may result from their actions when, for instance, acting under the influence of drugs. Regardless, even if offenders do act rationally, they may not possess the ideal knowledge of every situation that will result from their actions (Clarke and Cornish, 1985). In other words, it is fair to say rationality does not always translate to realization. It is also important to note that an individual's perception of benefit and cost of offending may vary with regards to, for example, the type of crime involved. This concept of viewing offenders as reasoning criminals that act rationally is yet to be fully developed into a well-grounded criminology theory. At the moment, it remains a set of working assumptions that could help in analysing the conditions that lead to a crime event (Cornish and Clarke, 2008).

Routine Activity Theory

It is a widely accepted perception that an increase in economic deprivation leads to an increase in rates of crime. The post-World War II period in America saw a phenomenal increase in rates of crime, and to explain this, scholars at the time (mostly sociologists) attributed the trend to the high economic deprivation that

characterized that period. However, despite tremendous improvement in the economy in the years that followed, rates of crime continued to increase in America. It is in this context that Cohen and Felson (1979) proposed the routine activity approach – an ecological perspective that was intended to explain how changes in the day-to-day activities of people might affect rates of crime.

The routine activity approach (Cohen and Felson, 1979) suggests that predatory crime, as defined in Glaser (1971), occurs when a motivated offender encounters a potential target in space and time in the absence of capable guardianship. The theory proposes that the pattern of people's routine activity affects the rate of crime by influencing the interplay between these three elements. Hence, any changes in people's lifestyle that would facilitate the interaction of these three basic elements of the theory will increase the probability of crime to occur. This is true in a city, as Cohen and Felson (1979) argued, regardless of stability in the supply of potential targets or motivated offenders. Therefore, the societal norms (e.g. more or less women in workplace) that shape the way people conduct their lives can influence how frequently these three elements come together. It is fair to say, as Tittle (2000) mentioned:

“.....whether or not the three [a motivated offender, a suitable target, and the absence of capable guardian] come together presumably reflects how people in a given social context conduct their lives and pursue sustenance activities”.

(p.73)

Using a longitudinal data for the US (between 1947–1974), Cohen and Felson (1979) tested the hypothesis of routine activity theory and found that, dispersion of activities away from family and household – estimated as the proportion of female in labour force participation (household activity ratio) – is positively associated with the rates of crime. Similar evidence is reported in a subsequent paper (see: Felson and Cohen, 1980). The routine activity approach was initially introduced as a macro-level theory but later applied to the study of crime at the micro-level of place, a point which I will return to. The theory was proposed at a time when the ecological approach to understanding crime was unpopular among criminologists, or rather sociologists who dominated criminological thinking at the time. As a result, *“the original article [that first introduced the theory] was rejected by six leading journals”*, often with harsh comments from reviewers (see: Felson, 2008: p.72).

Since its publication over three decades ago, however, the routine activity approach has (arguably) evolved to become among the most

(if not the most) influential theory in contemporary environmental criminology. The theory has undergone a number of developments. Most noteworthy are the introduction of the concept of controllers (Eck, 1995; Felson 1995) and more recently, the redefinition of the guardianship component of the theory (Hollis et al., 2013). For instance, Felson (1995) recognised the need to introduce a fourth element termed the ‘handler’ who represents some form of control on the side of the offender. This is based on the assumption that, a handler, such as parent or teacher can provide supervision of a potential offender, which in turn may influence their activity and behaviour, increasing the likelihood of them being law abiding (Felson, 2008). Thus, the actions of handlers have the potential to disrupt the conditions necessary for a crime to occur, unless the offender manages to escape the handler or their influence. Eck (2003) further developed these ideas and introduced the problem triangle (also known as the crime triangle) which is shown in Figure 2.1.



Figure 2.1: Crime triangle - Source: Clarke and Eck (2003)

The crime triangle portrays how a component of supervision could be attached to each of the three elements that must converge for crime to take place. In this context, the handler controls the offender; the guardian protects the target against crime, while the manager oversees the crime place. Felson (1995) suggests that crime becomes highly unlikely when ‘direct supervision’ of all the three elements is being strengthened. It is worth noting that a guardian is not only seen as a person, such as a police officer or security guard, it could also be in the form of technology (e.g. CCTV) or other deterrent effects. The misconception of what or who a guardian is has been noted in the criminological literature. For instance, Marcus Felson acknowledged that, regarding the misconception about who a capable guardian is, “... *not all who quote the theory get it right*” (Felson, 2008: 71).

Picking up on an earlier point, the routine activity theory has been applied to the study of crime at both the macro and micro-level of place. The macro level dimension of this theory, as demonstrated in the first article (Cohen and Felson, 1979), explains how certain social changes in the larger society facilitate the interaction between potential targets and motivated offenders (also see: Bennett, 1991). At a micro level, the framework of routine activity theory has been employed to address key research questions that focus on a

household's or an individual's risk of victimisation. For instance, using a sample of over 100,000 residents in 13 US cities, Miethe et al., (1987) demonstrate how routine activities outside of home – measured as frequency of night activities and whether a person does not work near home – is positively associated with risk of victimisation even when other demographic variables are controlled.

In a nutshell, the routine activity approach to understanding the trend in rates of crime is largely to do with changes in the patterns of people's movement and how such influences the likely convergence of potential targets and motivated offenders, a point which Felson (2008) suggests many that cited the theory have missed. It is assumed in this approach that, for instance, when more people are in the labour force, many homes will remain unguarded during working hours, presenting an opportunity to motivated offenders who could break into such homes without much fear of being caught. Similarly, those who go out of home frequently (e.g. for workplace, entertainment, shopping) will be at a higher risk of victimisation (e.g. pickpocket, assault).

Crime Pattern Theory

As a condition for crime to occur, the routine activity theory suggests that an offender must meet a suitable target at the absence of capable guardian. This condition is facilitated, as Cohen and Felson (1979) demonstrate, by the patterns of people's daily activities. As such, it implies that crime will occur at certain places as people – some of whom will be offenders, some of whom will be suitable targets – will often converge at particular locations as a consequence of their routine activities. However, precisely where, when, or how do offenders meet or choose their targets is not explicitly defined in the theory. Building on the discussions of rational choice and routine activity perspectives presented in the previous sections, crime pattern theory was developed to address these kinds of questions. In fact, the crime pattern theory provides the spatial dimension of the routine activity theory (Johnson, 2010).

Brantingham and Brantingham (1981; 1993a; 2008) argue that a crime event is a product of a complex process that has a number of variable elements. These elements are not static – they change rapidly in both time and space. To understand a crime event therefore, we need to understand how these elements come together and interact in both time and space. Crime pattern theory

(Brantingham and Brantingham, 1981; 2008) considers how the routine activities of people create a criminal opportunity structure. Offenders become aware of the crime opportunities within their “awareness spaces” – places they get to know as a result of their normal (non–criminal) day to day life. As Johnson et al. (2007) note, a lot of crime opportunities exist within criminal’s awareness space. For example, leaving a window wide open may alert a burglar passing–by to a crime opportunity that exists. These awareness spaces are formed around major routine “activity nodes” – places where people (both offenders and targets) visit frequently (for example home, work place, shopping centres, schools, regular bar etc.), and along “paths” – the links they follow to get to those places.

Crime pattern theory (Brantingham and Brantingham, 1981; 2008) suggests that as people go about their daily routine activity, the convergence of a potential target and motivated offender is more likely to occur around major activity nodes and along pathways, a point which I will return to. Because offenders can only explore (in theory) the crime opportunities of which they are aware, it is more likely that they will select targets around those activity nodes and along paths that fall within their awareness space (see: Rengert and Wasilchick, 1985; Feeney, 1986; Gabor et al., 1987; Bernasco et al., 2013). Consequently, people are more likely to experience crime near

routine activity nodes or pathways that they share with motivated offenders.

As crime pattern theory also posits that crime occurs at the intersection of a criminal's awareness space and the potential target's activity nodes or the pathways that connect them, picking on an earlier point, this suggests that areas that attract a large number of people are more likely to have higher rates of crime. Routine activity nodes that are frequented by large numbers of people, such as shopping areas, busy roads or popular recreation areas readily come to mind. These places bring together potential targets and motivated offenders through their daily routine activities. In considering how different activity nodes shape opportunities for crime more generally, Brantingham and Brantingham (1995) identify four broad types of urban settings: crime generators, crime attractors, crime-neutral sites, and fear generators.

Crime generators such as shopping centres or entertainment districts are those places that attract large numbers of people for legitimate reasons, some of whom will be offenders. Such areas create conditions conducive for some types of crime as offenders take advantage of the serendipitous opportunities they encounter, pick-

pocketing for example. Crime attractors can be seen as places that offer well-known crime opportunities (e.g. drug markets), and to which offenders travel for the sole purpose of engaging in crime. These two settings will suffer higher rates of crime, although generators will suffer lower rates per opportunity.

The third setting, a crime-neutral site, is neither favourable for committing a particular crime nor does it present well-known criminal opportunities. Crime at this type of setting is usually undertaken by insiders (people that are considered part of that setting, such as a house maid). The fourth type of setting, the fear generator, is a setting that makes people fearful of being victimised. However, such places are not necessarily risky, only that they create a feeling of being exposed to crime, which varies among age groups, gender and social class (Hale, 1996), as a result of perceived vulnerability.

The hypothesis of crime pattern theory has gained empirical support. As Cromwell et al., (1991) indicate for instance, burglary victims live close to places where offenders spend most of their non-criminal life. Likewise, burglars are more likely to select targets within their awareness spaces, particularly near their homes (Johnson et al., 2007; Block and Bernasco, 2009; Townsley and

Sidebottom, 2010), exploring the opportunities that they are aware of the most, perhaps to reduce the uncertainties associated with targeting places that they are not familiar with. However, criminal decision making takes a certain pattern that depends on the level of knowledge an offender possesses regarding the suitability of a potential target. As a result, not all targets within the offender's awareness space are victimised; they have to be deemed suitable by the offender (Brantingham and Brantingham, 1993b).

2.4 Crime Control and Prevention

A number of perspectives have emerged to suggest ways in which we can prevent crime by modifying the environment we live in (e.g. Jeffery, 1971; Newman, 1972; Clarke, 1980). This could be in the form of eliminating the criminogenic elements in crime prone locations, or to put differently, altering the situation that allows an offender to commit a certain crime. This section presents those perspectives that are concerned with crime prevention and control, including theoretical explanations to what happens at the wake of a successful prevention initiative.

The desire to limit the opportunities for crime through modifications to our physical environment dates back centuries but research in this area is relatively new. Of the work conducted to date, two perspectives – *Crime Prevention through Environmental Design* (see Jeffery, 1971; Newman, 1972; Moffat, 1983; Crowe, 2000) and *Situational Crime Prevention* (see Clarke, 1980; Clarke, 1983; Clarke and Homel, 1997, Cornish and Clarke, 2003) – have been the most influential. These perspectives, as Clarke (1997) has acknowledged, more or less employ a similar approach to how we can address crime prevention and control – although the works were initially conceived independently, their development happened around the same period. Generally, these environmental criminology approaches seek to reduce the opportunities for crime through a strategic alteration of the situational factors or physical settings at which a crime event is likely to occur. This is a shift from the traditional criminological approach to crime control and prevention, which focuses on changing the behavioural dispositions of offenders.

Crime Prevention through Environmental Design

The term crime prevention through environmental design (CPTED) was coined by C. Ray Jeffery in his 1971 book of the same name. Although the work of Jeffery (1971) was largely overlooked

throughout the 1970s, the term was adapted by many researchers (for example: Newman, 1972; Moffat, 1983) to refer to crime prevention strategies that focus on the effective design of the built-environment to reduce opportunities for crime. At about the same time as Jeffery's work, Oscar Newman published his book in 1972 entitled '*Defensible Space*' which argued that a place becomes safer when residents feel a sense of ownership or territoriality that they can act upon. A clear demarcation of spaces enables the regulation of who should and who should not be seen at those places. This allows residents to identify and challenge strangers and in turn (theoretically) reduces the rate of crime in such areas. This idea has gained a lot of attention and had a great impact on housing projects in many parts of the world (Clarke, 1997).

Building on Newman's concept of defensible space, Moffat (1983) suggested that six components characterise the idea of crime prevention through environmental design namely: territoriality; surveillance; access control; image/maintenance; activity support; and target hardening (see Figure 2.2 for illustration). The idea is that when these six components are fully realised, offenders will perceive themselves to be under strict observation and more at risk of apprehension, which will in turn make the area less attractive to

them (Cozen et al., 2005). This is the premise of rational choice perspective (Cornish and Clarke, 1986).

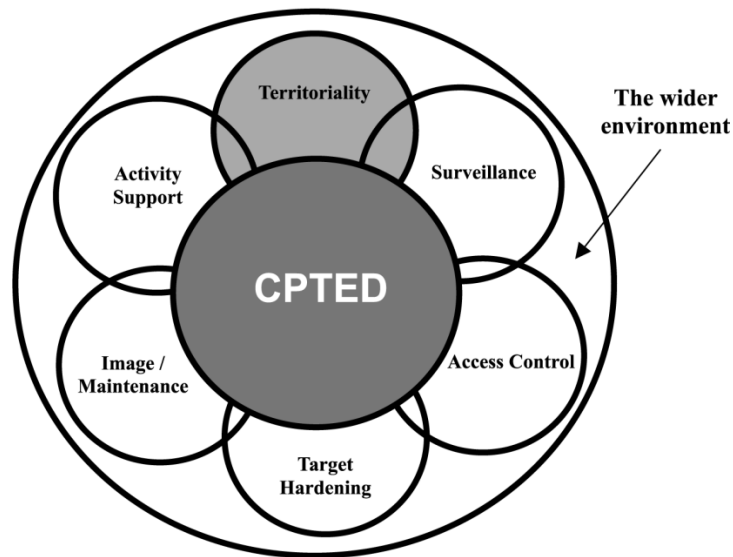


Figure 2.2: Key components of CPTED (Adapted: Moffat, 1983, p. 23)

The first component of CPTED is territoriality, seen as a sense of ownership that encourages space owners to challenge the presence of any stranger. Although this component varies across cultures and social groups (Merry, 1981), it is most effective at the local level (Ratcliffe, 2003).

The next is surveillance. This component has for a long time been recognised as a key factor to reducing the risk of crime (Cozen et al., 2005). Obviously, most offenders do not want to be caught and a strict observation of an area, either natural (e.g. having more people

on the street) or organized surveillance (e.g. CCTV, security guard), increases that risk. For instance, Jacob's (1961) idea of "eyes on the street" is based on the notion that natural surveillance provided by local residents will reduce the rate of crime and anti-social behaviour in an area. The risk of crime in an area would also be reduced when there is an organized system of surveillance such as the presence of security guards in an area (Clarke et al., 1991), installation of CCTV cameras (Poyner, 1988; Webb and Laycock, 1992) and lighting after dark (Painter, 1991; Farrington and Welsh, 2002).

Another important component of CPTED concerns access control. In fact, this is among the oldest techniques known to be linked to crime prevention (Brantingham and Brantingham, 1993b). Access control decreases the likelihood that an offender will learn about criminal opportunities in an area. Recent research (for example: Ekblom, 2002; Armitage, 2007) suggests that areas with unrestricted access are more likely to have a higher rate of crime than areas with effective access control.

Activity support is the fourth component of CPTED. The kind of activity that takes place in an area has some effect on the risk of crime. Unsafe activities (for example, involving a lot of cash) lead to

higher risk of crime while safe activity areas (for example, residential areas) are less attractive to offenders. The effect of this CPTED component is better illustrated using the example below, as Cornish and Clarke (2008) cited:

“When asked why he robbed banks, Willie Sutton is said to have replied, ‘because that’s where the money is’ (Cocheo, 1997)”

(p.21)

The component of image/management relates to how the appearance or physical condition of the built environment influences the risk of crime. For instance, an untidy environment such as the presence of graffiti on the walls or indiscriminate littering can signify that nobody cares or at least is willing to challenge any unwanted behaviour in the area and this may attract nearby offenders (Taylor and Gottfredson, 1986). Wilson and Kelling (1982) elaborate on this assertion which they refer to as the *‘broken window theory’*. The hypothesis is that when a broken window in a building is left unrepaired, more will follow because no one cares.

Finally, target hardening is the sixth component of CPTED. Cozens et al. (2005) noted that while disagreement still exists concerning whether or not target hardening is regarded as a component of

CPTED, it plays an important role in crime control and prevention. This component makes it harder for crime to occur (for example, the use of padlocks, security doors etc) which increases the effort of an offender in the process of committing an offence. This element of CPTED has been found to be effective in reducing crime, particularly in research conducted in the UK (Tilley and Webb, 1994; Budd 1999; Armitage, 2004; Hirschfield et al., 2010).

Situational Crime Prevention

The concept of situational crime prevention (Clarke, 1983) is an environmental criminology perspective that focuses on explaining how crime could be reduced through the alteration of situational factors. The guiding principle of this perspective is that opportunity is the root cause of a crime event. If these opportunities could be removed, crime would be reduced drastically. This idea, as Clarke (2008) has acknowledged, is deeply rooted in other environmental criminology theories particularly the rational choice perspective (Cornish and Clarke, 1986), routine activity theory (Cohen and Felson, 1979) and crime pattern theory (Brantingham and Brantingham, 1981).

Crime opportunities are generated at different types of urban settings that produce various situations involving both the motivated offender and the potential target (Brantingham and Brantingham, 1995) and the idea is that reducing these opportunities will reduce the amount of crime in such settings (Clark, 1997; Clarke, 2005). The situational crime prevention approach tends to address this and various techniques have been developed over the last thirty years – Clarke (1983) initially categorized prevention measures into three classes namely: surveillance; target hardening; and environmental management. This has been revised to sixteen techniques (see: Clarke and Homel, 1997) and more recently twenty five techniques that are categorized under five broad areas namely (1) Increase the effort⁵; (2) Increase the risk⁶; (3) Reduce the reward⁷; (4) Reduce provocations⁸ and (5) Remove excuses⁹ (see: Cornish and Clarke, 2003).

⁵ Increase the Effort: (1) Target harden (2) Control access to facility (3) Screen exits (4) Deflect offenders (5) control tools/weapons

⁶ Increase the Risks: (6) Extend guardianship (7) Assist natural surveillance (8) Reduce anonymity (9) Utilize place managers (10) Strengthen formal surveillance

⁷ Reduce the Rewards: (11) Conceal targets (12) Remove targets (13) Identify property (14) Disrupt markets (15) Deny benefits

⁸ Reduce provocations: (16) Reduce frustrations and stress (17) Avoid Disputes (18) Reduce emotional arousals (19) Neutralize peer pressure (20) Discourage imitation

⁹ Remove excuses: (21) Set rules (22) Post instructions (23) Alert conscience (24) Assist compliance (25) Control drugs and alcohol

From the rational choice perspective (Cornish and Clarke, 1986), opportunities that require much effort are less attractive to potential offenders (see for example: Hirschfield et al., 2010). The first set of situational crime prevention techniques aims to increase the efforts that an offender has to make when committing a crime. Evidence exists to support the effectiveness of this technique in crime reduction such as target hardening (see: Cozens et al., 2005; Hirschfield et al., 2010) and access control (Ekblom, 2002; Armitage, 2007). The technique that focuses on increasing the risk of committing crime is based around the idea of capable guardianship. Offenders do not want to be caught or face intense resistance from a target and increasing this risk can help in reducing crime. As most crimes come with benefits, be it material or satisfying one's desire, reducing such gains will (according to this perspective) discourage crime.

The last two sets of techniques (reduce provocation and remove excuses) focus on addressing the triggers of emotion. People are less likely to offend when provocation is reduced (Clarke, 2008). For instance, queuing for services reduces disputes between customers and provocative statements that could otherwise result to disorder. While offenders always try to rationalize their actions (Cornish and Clarke, 2008), creating situations that checkmates excuses will

reduce the ability of offender to justify his actions. This can be achieved by setting and making rules very clear. For example, a “No Parking” sign eliminates the chances that a parking offender will use the ignorance of law to justify his action.

At this point, it is important to note that intervention against crime is specific in the sense that the situational factors that make crime more likely to occur may vary across space and time, even for the same type of offence. In general, the situational crime prevention approach to crime reduction is context dependent. To put it differently, the techniques of situational crime prevention are mostly place, time and type of crime specific – focusing on reducing opportunities for crime through a thorough understanding of the situation that creates them. However, one criticism of situational crime prevention, as Cornish and Clarke (2003) noted, is that the approach does not address the so called root cause of criminality (changing the motivation of an offender), thus preventive measures will have no effect on the overall reduction in rates of crime. This criticism has been debunked (see: Clark and Weisburd, 1994; Guerette and Bowers, 2009), an issue that is discussed in the next section.

Crime Displacement and Diffusion of Crime Control Benefit

The perspectives of environmental criminology reviewed in this chapter have articulated (theoretically) what informs offender decision-making (rational choice perspective), how crime events occur (routine activity approach and crime pattern theory), and how such events could be prevented or controlled (CPTED and situational crime prevention). Additionally, much of the empirical research regarding crime prevention and control cited here has pointed to evidence that intervention programs have positive effects on reducing the opportunity for crime. However, will such intervention initiatives contribute to the overall reduction in rates of crime? How could a motivated offender react in the wake of a successful intervention initiative? Two perspectives have emerged regarding these questions – one is crime displacement and the other is diffusion of crime control benefit.

Considering the argument of crime displacement first, some have argue that situational intervention measures will only shift a crime event from a particular location, time, or target (where there is an intervention program) to another (perhaps where there is not), or feasibly so, making an offender to switch from one form of

criminality to another (see: Gabor, 1990). The assumption is that, even when opportunity for crime is reduced in a particular place, offender motivations will remain unchanged. In other words, intervention initiatives will not address the so-called root cause of criminality. Consequently, a motivated offender will seek to explore other crime opportunities that perhaps have not been affected by the intervention initiative. If this occurs, the intervention measures would have no net effect on reducing the overall rates of crime.

Crime displacement could take six possible forms (see: Hakim and Rengert, 1981; Barr and Pease, 1990; Hesselings, 1994; Bowers and Johnson, 2003) that include:

- Spatial – the relocating of crime event from one place to another
- Temporal – where for instance, crime is prevented from occurring during the daytime only for it to happen in the night
- Tactical – when an offender employs different method in committing an intended crime
- Target – refers to a change in intended target

- Crime type – when offender switches between crimes (e.g. from burglary to shoplifting)
- Perpetrator (offender) – where an offender takes the opportunity for crime left behind by another offender, for instance, who has been arrested

For the six forms of crime displacement highlighted above, spatial displacement has been the most commonly discussed in the research literature (Eck, 1993; Johnson et al., 2014). The first five forms of displacement were identified by Hakim and Rengert (1981) while the sixth was introduced by Barr and Pease (1990). It is important to acknowledge that, as many studies have often failed to do, it is possible for more than one form of crime displacement to take place concurrently (Hesseling, 1994). For instance, a burglar could change location (e.g. move to another neighbourhood), time (e.g. from morning to evening), and switch between offences (e.g. breaking and entering to theft from automobile) simultaneously.

Considering what would happen theoretically in the wake of an intervention, Clarke and Weisburd (1994) suggest the direct opposite of crime displacement, which has now become known in the literature as diffusion of crime control benefits. This perspective posits that situational preventive measures would not only reduce

the opportunity for crime in a target area, the effect will go beyond such intended intervention areas – thus contributing to the overall reduction in rates of crime (see: Clark and Weisburd, 1994). Two underlying processes underpin the idea of diffusion of crime control benefits – deterrence, resulting from offender's perceived uncertainty regarding the level of increased risk of offending, and discouragement, when offender sees the reward of offending is no longer worth the risk involve or the effort required for a crime to be successful.

These phenomena of crime displacement and the diffusion of crime control benefits have attracted considerable research attention (for example: Barr and Pease, 1990; Eck, 1993; Hesselning, 1994; Bowers and Johnson, 2003; Guerette and Bowers, 2009; Johnson et al., 2012). Many of the studies, as mentioned earlier, have been focused on spatial displacement – investigating the extent to which situational prevention measures have led to crime displacement and whether such phenomena will affect the net reduction in the rates of crime. The most consistent finding from such studies is that, although displacement is a possibility, its effect on net reduction in the rates of crime is only partial (for example see: Eck 1993; Hesselning 1994; Guerette and Bowers, 2009; Bowers et al., 2011; Johnson et al., 2012; Telep et al., 2014).

It is important, however, to note that as crime displacement can occur in different forms, it is extremely difficult to provide conclusive proof that it is quite limited following an intervention (Clarke and Weisburd (1994). While consensus regarding the effectiveness of intervention measures on the overall reduction in rates of crime is yet to be reached, it is entirely feasible that, at least from a theoretical standpoint, interventions could lead to both crime displacement and diffusion of crime control benefit (Johnson et al., 2014).

2.5 Conclusion

It is clear that research on spatial patterns of crime has gained considerable attention in the last three to four decades. Advances are evident from a theoretical perspective, how we can better understand crime events, prevention and control, and in terms of the empirical research conducted to test the validity of such theories. This trend has addressed a lot of pressing questions with some fascinating explanations as to why, where, when and how crimes occur. As new evidence continues to emerge prompting new sets of questions, much research is still needed to provide more answers (Wartell and Gallagher, 2012). It is important, however, to note that

contributions to this field of enquiry have largely focused on Euro-American cities, with very little attention to settings in the developing world particularly sub-Saharan Africa. Of course, this trend is for some obvious reasons, one of which is the availability of appropriate data (see: Igbinovia, 1989; Arthur, 1994; Appiahene-Gyamfi, 1999; Mushanga, 2004; Sidebottom, 2013).

As data are gradually becoming available in some countries, the spatial patterns of crime in sub-Saharan Africa is beginning to attract research interest. For instance, using police recorded data (1980 – 1996), the PhD work of Joseph Appiahene-Gyamfi applied environmental criminology approaches to examine the spatial ecology of six crime types in Ghana (see Appiahene-Gyamfi (1999). Although much of the analyses presented in that work are descriptive – no statistical tests were conducted – the findings suggest that crime is unevenly distributed across regions of Ghana. Considering the patterns of journey to crime in the city of Accra, the study also revealed that suspected burglars lived in blighted neighbourhoods but travelled to more affluent ones to commit burglary offences (also see Appiahene-Gyamfi, 2003)

Other studies conducted in Ghana have also utilised the environmental criminology approach to provide insight on the

patterns of urban crime. More recently, for instance, Owusu et al. (2015) found that rising crime rates in the city of Accra has led to the adoption of target hardening measures (e.g. use of burglary-proofed windows, high walls, security doors etc). Responding to crime through these measures in the context of Ghana, however, has had limited impact on the rates of crime in communities and in the long-term, has tendency to weaken social cohesion.

In another PhD work concerned with spatial patterns of crime in sub-Saharan Africa, Sidebottom (2013) utilised the environmental criminology framework to explore whether crime opportunity theories could explain the victimisation patterns in Malawi. This study used data from the Malawi Integrated Household Survey 2004–2005, specifically, exploring the patterns of livestock theft, residential burglary (including repeat burglary victimisation), and assault (including reporting assault to the police). The author concluded that “Opportunity theories of victimization have purchase beyond the Western settings in which they were forged and tested, with implications for crime prevention” (Sidebottom 2013: 272). Whilst environmental criminology research concerned with sub-Saharan Africa is notably scarce, it is evident from the above examples that efforts have been made to understanding the patterns of urban crime in such settings.

Although the findings of the abovementioned studies remain valid, their analyses have been limited to particular lines of enquiry due to the availability of detailed data at a micro-geographic scale regarding the condition of the built environment. The central objective of this thesis, therefore, is to extend these existing works. It considers the likely utility of the mainstream Euro-American theories of crime – specifically, law of crime concentration at places (Weisburd, 2015), social disorganisation theory, and the opportunity theories – in explaining the spatial patterns of crime in a city in sub-Saharan Africa, Kaduna – Nigeria. The cross-cultural application of these theories provides an opportunity to test their applicability to other context.

The aim of this chapter was to highlight progress in the development of theories regarding spatial patterns of crime that are largely developed based on the experiences of cities in developed countries. Building on this, the theoretical assumptions of these theories could be contextualised to reflect the local conditions of settings like Nigeria. This will help in making informed assumptions particularly regarding the formulation of key research questions, hypotheses testing, and conducting a robust analysis and evaluation.

Chapter 3

Data and Methods

This chapter presents the data collection methodologies utilised in the substantive analysis sections of the thesis. The chapter begins with a brief description of the study area – Badarawa–Malali – an urban district in the city of Kaduna, Nigeria. To provide a broader context regarding the study area, I first describe the country Nigeria and the city of Kaduna before proceeding to why Badarawa–Malali is selected for this study. This is followed by a discussion on the availability of relevant and a reflection on the initial ideas that were conceived at the onset of this project regarding data collection. Next is a description of the data collection methodologies, the fieldwork that is associated with each, as well as, the summary of the data that were collected. The last section reflects on the lessons learnt regarding the processes involved in the data collection exercises.

3.1 Focus of the Study

Nigeria

Nigeria, formally known as the Federal Republic of Nigeria (FRN), is a West African nation located between latitudes 4° and 14°N, and longitudes 2° and 15°E (see Figure 3.1). The country was a former British colony that gained independence on the 1st October 1960. It shares its borders with four countries – Cameroon and Chad (east), Niger Republic (north), and the Republic of Benin (West). The country has a total land area of about 923,768 km² with a coastline of 853 km on the southern border. Nigeria operates a federal system with three tiers of government – one at the centre (the first tier), and 36 at state level (the second tier) that are further divided into 774 local government areas (the third tier).

Nigeria has the largest economy in Africa with an estimated population of around 187 million (World Population Data Sheet, 2016), making it also the most populous nation in the continent by far and the 7th in the world. The urban share of this population is 47%, indicating a massive 57% increase from 1990 (United Nations, Department of Economic and Social Affairs, 2014). The population is also culturally diverse – with over 300 different tribes (Otitie 1990; Rakov 1992). Recently, Ethnologue (2015) revealed that 526 languages are spoken in the country.

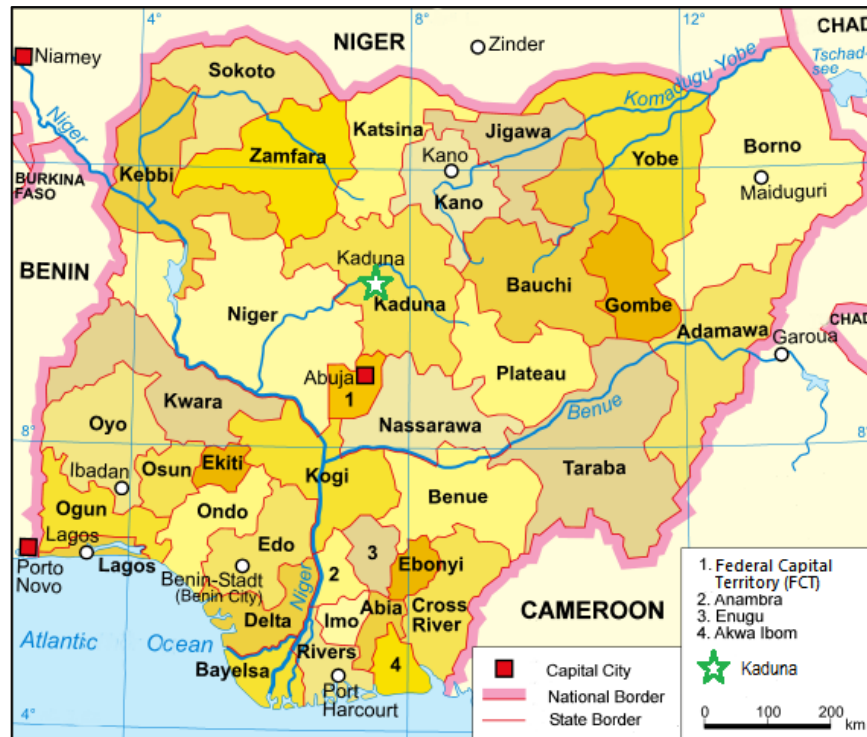


Figure 3.1: Map of Nigeria with 36 states

Source: Wikipedia <<https://en.wikipedia.org/wiki/Nigeria>>

Policing and Crime Trends in Nigeria

Policing in Nigeria is the constitutional responsibility of the central government (i.e. there are no state or local government police) through the Nigerian Police Force (NPF). Other government agencies (paramilitaries) such as the Nigerian Security and Civil Defence Corp (NSCDC), Federal Road Safety Commission (FRSC), and Nigerian Drugs Law Enforcement Agency (NDLEA), however, complement the NPF in maintaining law and order across the country. There are also other organized local community-based vigilante groups that contribute to the informal policing at local area level.

The official crime statistics, published by the NPF, suggest a progressive decrease in the rates of crime (reported to the police) in the country. Figure 3.2 shows the trend for all crime types (right panel) and those of property-based crimes (left panel), over a 12 year period (1997 – 2008). Property-based crimes (e.g. theft/stealing, burglary, breaking and entering) are by far the most common crime types in Nigeria (Ebbe, 2000). The crime statistics for the periods 2009 and onward are not available.

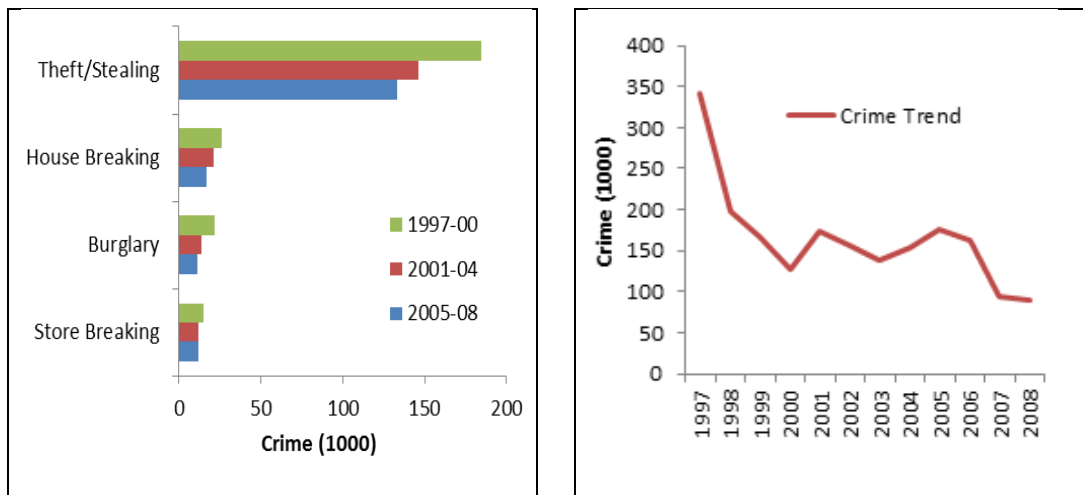


Figure 3.2: Crime trends in Nigeria (1997 – 2008) – based on the official data published by NPF

As will be discussed in detail, official crime statistics/data in Nigeria should be treated with caution – the data plotted above is perhaps only a fraction of the actual rates of crime in the country. For instance, an annual national crime victimisation survey conducted by a reputable non-governmental organization, the Centre for Law Enforcement Education in Nigeria (also known as CLEEN

Foundation) has consistently revealed a high rate of underreporting and the trend has gradually increased over the years (see Alemika, 2013)¹⁰. Additionally, Ebbe (2000) suggests that these records do not include crimes committed in the rural districts, making it very difficult to study rates of crime in Nigeria. It is worth noting that these issues are not unique to Nigeria – the situation is similar in many other countries across sub-Saharan Africa. For instance, Sidebottom (2013) reported that police crime data is not available in Malawi, which perhaps could partly explain the lack of criminology research in such country.

Kaduna Metropolis

Kaduna is the capital city of Kaduna state – the third largest state in Nigeria. The city was founded around 1913 by Sir Fredrick Lugard, the first Governor-General of the colony and protectorate of Nigeria to serve as the capital of the country. It is strategically located at the centre of Northern Nigeria – about 210km north of Abuja, the present seat of the federal government (see Figure 3.1). Kaduna serves as an important regional transportation hub and is

¹⁰ The trend of underreporting, as revealed in the CLEEN Foundation crime surveys (2005 – 2013), are as follow:

- 2005 - 70.1%
- 2006 - 79.7%
- 2006 - 79.8%
- 2010 - 84%
- 2012 - 79%
- 2013 - 82%

considered to be the symbolic political capital of Northern Nigeria. Unlike the typical pre-colonial cities in the country that are characterized by conservative traditional urban settings, Kaduna exhibits influences of western town planning. The map of the city is shown in Figure 3.3.

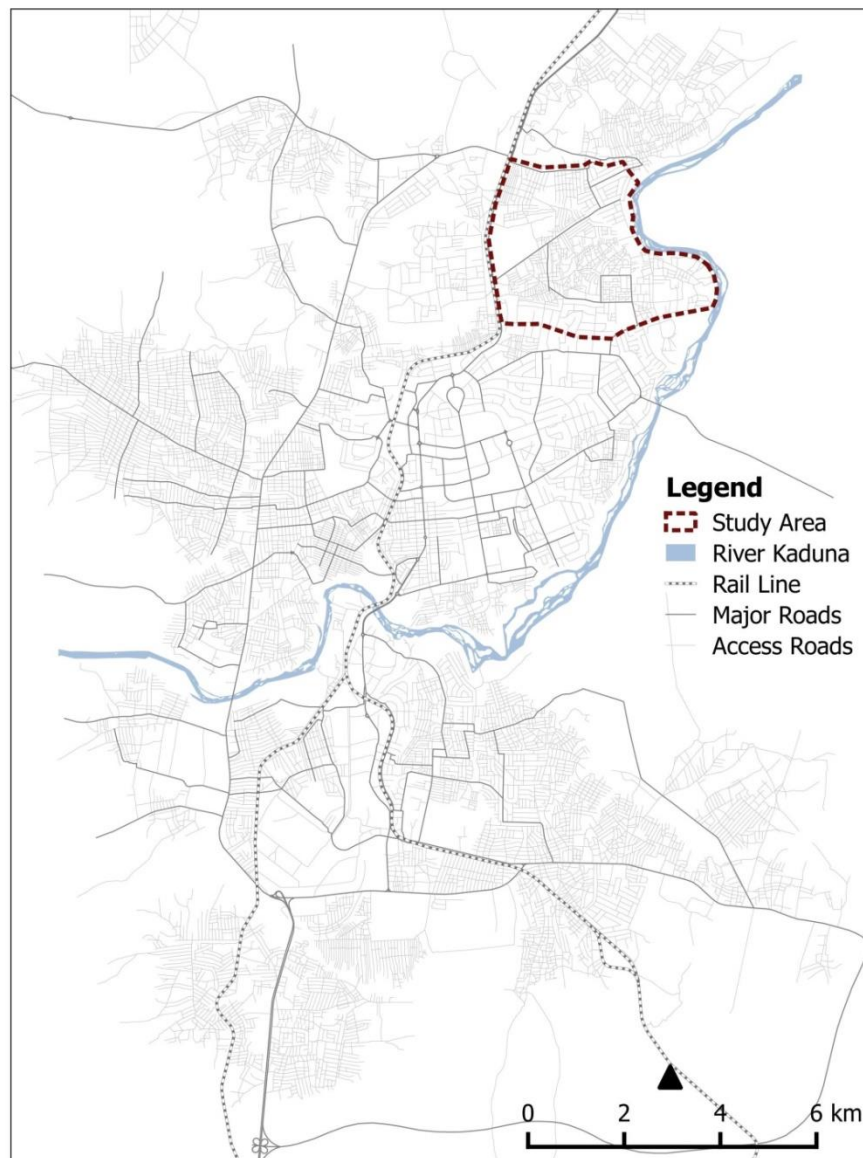


Figure 3.3: Kaduna metropolis

© Digitised and designed by Faisal Umar 2013

Descriptive statistics and other details of the city (and also the study site) discussed here are largely drawn from the work of Max–Lock Consultancy Nigeria (MLCN) (2010), an urban planning consortium commissioned by the government of Kaduna to map and review the master plan of the city. Kaduna metropolis occupy a total land area of about 250 km² with an estimated population of 1.14million (MLCN 2010), and therefore has a population density of about 4,560person/km². The population of the city is very diverse with Kaduna being home to almost all of the major ethnic groups in Nigeria, and some foreign nationals (Bununu et al., 2015).

The Study Site – Badarawa–Malali Urban District

There are 65 “traditional” districts in the city of Kaduna. These traditional districts are organized into twenty–four ‘urban’ districts (wards) – the smallest administrative units in the city (MLCN 2010). Due to the resources available, it was not practical to study the entire city in this PhD project, and so the present study is limited to two urban districts – Badarawa–Malali (all four traditional districts in this urban district) and part of Kawo (four out of six traditional districts in this urban district), which are highlighted in Figure 3.3. The estimated population of the study area is 137,540 (MLCN 2010). This represents 12% of the total population of Kaduna and 13% of all households in the city. The average household size is about 9.91 persons per household, which is similar to the city average of 9.88.

Why Badarawa – Malali District?

This study area was selected because, first, I have a good knowledge and understanding of both the physical and social settings of the area. Additional, I have a direct connection with a local partner, a university department in the state of Kaduna – the department of Urban and Regional Planning at Ahmadu Bello University (URP–ABU) – where I have worked as a lecturer. As will be discussed in this chapter, this connection helped when searching for relevant data at various sources such as the NPF and private firms, and also with the logistics for the fieldwork (providing enumerators for the survey). Second, and most importantly, there is considerable variation in terms of both the physical and social settings of residential neighbourhoods within these districts. No other districts in the city would provide such variation, making the district ideal for studying spatial patterns of urban crime.

Broadly, there are three distinct types of residential neighbourhoods within the study area, these being high, medium and low–density residential neighbourhoods. Figure 3.4 shows an example of a street in two distinct neighbourhoods within the study area (two extremes).



Figure 3.4: Example of streets within Badarawa–Malali

The high-density residential areas (right panel), which MLCN (2010) refer to as urban villages, account for almost 50% of the total residential land use. These areas have no formal physical planning. They are characterized by irregular plot layouts with narrow streets that are mostly unpaved. Despite being the most deprived communities, these areas have the strongest traditional community identity, which encourages neighbours to care for each other. In contrast, the low and the medium density residential areas exhibit western influences of physical planning. The streets are wide and mostly paved (left panel), with regular sized plots aligned and well-arranged on large street blocks. The most affluent groups in the population live in these areas – however, traditional community identity is weaker in these areas than in others (MLCN, 2010).

3.2 The Search for Data

This section provides my personal account regarding the search for the ideal datasets that are of concern to this project. It is important to note that, as Sidebottom (2013) highlighted, there is limited guidance in the criminology literature on how to address the practical realities concerned with research in settings of the developing world, particularly sub-Saharan Africa (for instance, issues regarding access to crime data and recruitment of research assistants). Consequently, the task of gathering appropriate datasets would perhaps be the first challenge to resolve at the onset of most criminology research that is concerned with such settings. With this in mind, I had made some preliminary enquiries regarding the availability and prospect of accessing various datasets (for example, at the Kaduna Police Command). The data required for this project fall into three categories:

- Crime data: information about crime and its attributes such as the location and period of incident
- Socio-demographic data: information about the population of interest such as socio-economic status, ethnicity, family structure etc

- Spatial data: information regarding the physical settings (i.e. base maps e.g. area boundaries) and features of the built–environment (i.e. location and attributes of individual properties)

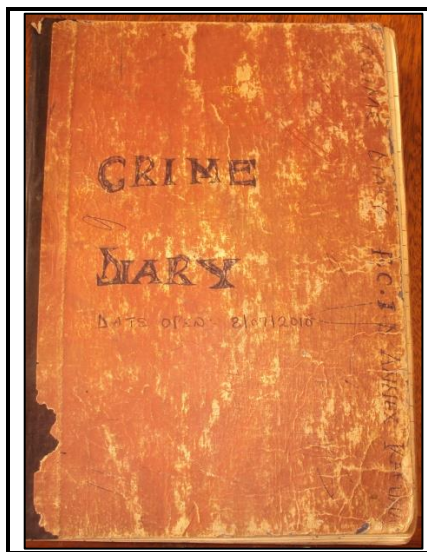
These datasets rarely exist in most resource limited countries, and where they do, as is discussed below, access is a major challenge.

Crime Data

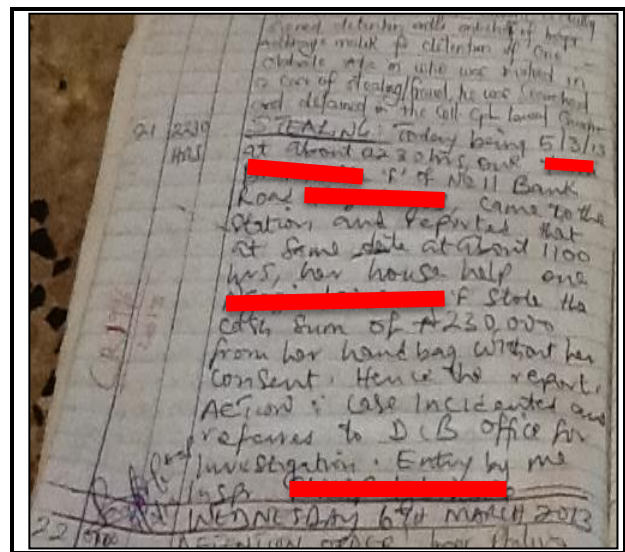
Empirical research in environmental criminology often relies on data from police incident reports. These are an official record of every crime (in theory) that has been reported to the police. The records would typically contain information about reported incidents and their attributes (for example, the type of crime, location, time etc.). In the developed world, these data are usually stored in digital format and are available for research purposes. As testing the applicability of Euro–American theories of crime is central to this PhD, the initial idea was to work with the incident report data held by the NPF.

The official process of recording crime in Nigeria starts with the victim (or another person) walking directly into a police station to report an incident. Other means of reporting crime such as call to the police or through online platforms are not available in the

country. In theory, every crime incident is to be reported to the police station nearest to where such crime occurs – although this is not the case in reality. Every police station in Nigeria maintains a single police crime diary (usually a notebook) where all reported crimes are manually recorded (i.e. not in digital format). Figure 3.5 shows a typical example of a police crime diary (on the left panel) and how entries of reported incidents are made (on the right panel). Typically, each entry would have the date, time and type of crime reported as well as the details of both the victim and any potential suspects.



Cover of a crime diary



Typical incident entry

Figure 3.5: The police crime diary

Table 3.1: Transcription of police incident report entry

S/N	TIME	C/R	DETAILS OF ENTRY
21	2230 HRS	CR 1996	STEALING: Today being the 5/3/2013 , at about 2230 hrs one [REDACTED] of [REDACTED] Bank Road [REDACTED] came to the Station and reported that, at same address at about 1100hrs , her house help one [REDACTED] has stolen the sum of N230,000 from her handbag without her consent, hence the report. ACTION: Case incident refers to D.B. Officer for investigation. Entry by me: Insp. [REDACTED]

However, it is important to note that not all entries into the police crime diary are as detailed as the one in the above example – for instance, many would be entered using the name of a nearby landmark such as a market or place of worship or local neighbourhood name rather than the specific address of where the incident occurred. This is symptomatic of the lack of a comprehensive addressing system that is not only unique to the city of Kaduna or Nigeria but also of many other places in developing countries. As such, this presents a major challenge for the geocoding of police crime data. Even if the geocoding were to be straightforward, the official police incident report data is not readily available for public or research use (Alemika, 2004).

Moreover, police incident reports in Nigeria, as mentioned earlier, only represent a fraction of the total number of committed offences (Ebbe, 2000; Gyong 2010; Ayodele and Aderinto 2014). Although the rate of reporting varies for different crime types even in the

developed world (see for example: Skogan 1984; Tarling and Morris 2010), under-reporting is generally a concern in most countries (Shaw et al., 2003; Sidebottom 2015). In addition, police incident report in Nigeria has been subject to controversy, including allegations of egregious acts of record alteration (Alemika and Chukwu, 2005). Consequently, official crime data in Nigeria would perhaps represent a bias sample of offences.

Despite all of the caveats discussed here, it was still considered worthwhile to attempt to access the police crime diary. The intention was to understand the structure of the police incident report data so as to propose and inform a better way of keeping such records (for example in a digital format). To do this, URP-ABU provided me an introductory letter to the Kaduna Police Command. My meeting with the police commissioner was arranged within minutes (thanks to the introductory letter) and went very well. We discussed the aim of the PhD research, how the data would be used, and the expected output of the project. The police commissioner expressed his readiness to approve the release of the data I requested. I was made to understand that this meeting would have taken days, or perhaps weeks, to arrange had I come from elsewhere (not from a well-respected University in the state).

However, I spent the next four weeks following up with the department at the Kaduna Police Command where my request was referred to. Finally, I was informed that approval was given to all the police stations within my study area to release the data. I went to those police stations to arrange on how I could start the work of extracting data from the crime diary but none seemed to acknowledge receiving any approval, or at least show any sign of interest in the project. After several attempts I concluded that working with the police incident report data would not be possible after exploring every means possible to secure access to the data.

Socio–demographic Data

Demographic data are also critical for criminological research. Independent variables are usually derived from such data to help explain the variations in observed patterns of crime. These variables are typically derived from data collected for government censuses. In developed countries such as the US and UK, for instance, population censuses are conducted every ten years or so and the data are readily available to researchers at different geographical scales of analysis. In Canada, the exercise is conducted every five years, while in the Netherlands, census data are essentially updated in real–time, making them not just available for research purposes but also incredibly up to date.

Although government population censuses in Nigeria are intended to take place every 10 years, in reality the National Population Commission (NPC) has only achieved this target on one occasion (the post-independent exercises were in 1963, 1973, 1991, and 2006). Furthermore, even when these censuses are conducted, the results have always been a subject of controversy – the consensus being that the census figures are skewed to favour a particular part of the country (Aluko 1965; Hollos 1992; Bamgbose 2009) – the reason being that population figures are considered in allocation of resources (Aleimika, 2013). Moreover, such population data are only available for large areal units – the smallest being local government areas, which have an average population of around 230,000. This poses problems for estimating population and other socio-demographic variables at the smaller geographic level.

Giving the limitations of census data, a search for an alternative source of socio-demographic data became necessary. One way to address this challenge was to get access to any existing (reliable) data from previous projects. The other, which would require more time and resources, was to conduct a household survey. To explore the first option, I had made several contacts within my network, mostly in the urban planning profession and colleagues that I have worked with at URP-ABU. The viable option (and perhaps the most reliable) that

consistently kept up from my discussions was to explore the possibility of getting the data held by MLCN.

MLCN had conducted an intensive socio–demographic survey (and also GIS mapping) of Kaduna metropolis in 2008 as part of a project that was aimed at reviewing the Kaduna master plan. The preliminary report of this project (see MLCN, 2010) has highlighted all the data MLCN had collected and processed. To explore the possibility of working with these data, I set up a meeting with a leading member of the MLCN team who is based at the University of Westminster’s Max Lock Centre (the principal partner of MLCN that was also directly involved with the Kaduna project). The meeting went well and had acquainted me with all the necessary information regarding the quality and contents of the data. However, the prospect of working with such data seemed somewhat complicated at the time as there were unresolved contractual issues between the government of Kaduna and some partners involved in the project.

None of the other identified sources (for example, department of Urban Planning at Kaduna Polytechnic and IDRIS Consultants Kaduna) seemed to possess any socio–demographic data appropriate for this PhD project. Consequently, a household survey was considered as a final option.

Spatial Data

Finally geographically-referenced datasets are required. These datasets take the form of base maps that show, for example, areal boundaries (e.g. neighbourhoods), street networks, and the location of individual properties. Additionally, each component of these data (i.e. every area, street, or property) should typically have a standard reference code that would allow the linking of datasets from different sources. These data are important in environmental criminology research – they facilitate the spatial referencing of the two datasets (crime and socio-demographic) discussed earlier in this section.

In the developed world, spatial datasets are readily (and also freely) available for various purposes including research. Ordnance Survey (a government agency in the UK) for instance, provides GIS data such as boundaries at no cost to researchers. These datasets could also be acquired freely from open sources such as OpenStreetMap¹¹, or from various private data companies at a cost. In much of the developing world, including Nigeria, such data sources are very rare. In fact, much of these settings have not been properly mapped (even by volunteers), and where they have been (for example by a private company or any government agency), they are hard to access.

¹¹ OpenStreetMap data for Kaduna is available here:
<http://www.openstreetmap.org/#map=13/10.5156/7.4285>

In this project, the first step I took was to search for any available existing data and to explore the prospect of using them (if they exist). To do this, I enquired at relevant government agencies and private firms that would ordinarily possess valuable datasets. First, I visited the Kaduna State Urban Development Agency (KASUPDA), the government agency that is responsible for the physical planning and monitoring of development in the city of Kaduna. The only available data I could find were paper maps produced over 30 years ago. These maps do not cover much of the study area (the new development). Additionally, the information on the paper maps only indicated a layout plan – not any information regarding the attributes of properties. The other agencies I have contacted were the Kaduna Water Board (the water company that supplies Kaduna) and the Power Holding Company of Nigeria (the electricity company that supplies Kaduna). Nothing promising came out from these agencies that will ordinarily hold spatial data regarding the location of all their customers.

In addition, I contacted a number of private companies in Kaduna that have worked with spatial data in the past. However, none of these companies, although they seemed to have useful data sets, would allow me to use their data. For instance, I found some useful datasets at one urban planning consultancy firm based in Kaduna. The firm is in possession of an up to date base map of the study area

that is in digital format (AutoCAD format). But as a private firm, which have invested much in collecting data for the production of those maps, it was difficult to convince the management to allow me use part of the data (at no cost) for this current research. With a limited chance of utilising existing datasets, the remaining option was to directly gather spatial data using well-established methodologies.

3.3 Data Collection

As discussed throughout the previous section, the availability of, and access to, appropriate data has posed a major challenge in this research project. Consequently, three fieldwork-based protocols were developed:

- A field mapping exercise to create a base map of the study area
- A Block Environmental Inventory (BEI) to obtain data on the condition of the built-environment (see Perkins et al., 1992)

- A household and crime victimisation survey to generate data on a range of demographic (independent) variables, perception of safety, and to obtain data on the rates of crime victimisation

Before considering each of these methods, this section begins with a discussion on the recruitment of enumerators and the logistics that were involved regarding the survey implementation.

Recruitment of Enumerators

A total of 25 enumerators participated in at least one fieldwork. Of those, 18 were from URP–ABU (graduates and students in their 4th and 5th year) while the remaining were diploma students at Kaduna Polytechnic (five) and one undergraduate student each from economics department at ABU and Kano University of Technology. Those from URP–ABU have completed a “Life Studio Project”, an undergraduate course that involves tasks of data collection through household survey and field mapping (I was involved in the teaching of this course).

The criterion for selecting a candidate, in addition to completing the Life Studio Project (those from URP–ABU), is that you must possess a good knowledge of the study area (preferably a local person that lives or has lived within or close to the area). This is to avoid any hazard that might arise from what some communities may perceive as alien

intrusion. For instance, this incident was reported in the Financial Times (FT) detailing hazards arising from using enumerators that are considered as aliens in one rural community in Nigeria.

“Once, he [Yemi Kale, the statistician general of the National Bureau of Statistics of Nigeria] says, he sent five of his 3,000 workers to collect data from a remote part of Ekiti, in the west of the country. Villagers surrounded the intruders and marched them to the chief, who threatened to kill them. Only intervention from Mr Kale’s headquarters calmed things down.”

(Pilling, 2016)

This incident is not surprising as the country is facing enormous security challenges in recent times. Although this example is not drawn from an urban setting and is located in the western part of Nigeria, communities across the country, particularly in the northern part of the country where Boko Haram (a deadly terrorist group) are most prevalent, are becoming very sensitive to any form of alien intrusion. Therefore, recruiting the right enumerators would be significant in the successful conduct of any local area survey in Nigeria.

All the enumerators that participated in this survey have undertaken a training course prior to the commencement of the fieldwork. This training consisted of two parts – the first was in the form of class–

based lessons and demonstrations on how to undertake the various tasks involved in the field mapping, BEI exercise, and the household and crime victimisation survey. Lessons also covered safety issues, and other survey ethics such as how an enumerator would initiate contact with a potential respondent. The second part of the training was a mock exercise to demonstrate how various tasks should be undertaken and how enumerators could address different situations that may arise in the field during each exercise.

It is important to note that all enumerators agreed to participate voluntarily – the only remuneration given to them was a token enough to cover lunch and expenses for transportation to and from the site, and a little reward (bonus) for those who completed their surveys on time. Only 18 enumerators (those from URP–ABU) participated in the mapping and BEI exercises. And, 20 enumerators participated in the household and crime victimisation survey of which 13 are from URP–ABU, and seven from the other three institutions previously mentioned. Five enumerators that participated in the BEI exercise but not the household and crime victimisation survey did so to resume classes after a two week mid–semester break (those are mainly 5th year students of URP–ABU, the 4th year students were on leave at the time as they were about to start an industrial training as part of their undergraduate programme).

A colleague (who is a lecturer at URP–ABU) and I participated as supervisors during the fieldwork. Our role was to monitor the activities of the enumerators through site visits to ensure each task was undertaken smoothly and according to the set guidelines. As each enumerator was expected to return every completed form or questionnaire each day, it was also the responsibility of the supervisors to check the completeness of such forms and questionnaires. Additionally, the supervisors would undertake fieldwork validation tasks at the end of every exercise, a process that is detailed below.

Fieldwork Implementation Strategies

Prior to the commencement of the fieldwork, it was necessary to engage with local leaders, who are often viewed as custodians of the local tradition. These leaders command esteem regard among the local population. I met with an influential member of the *Zazzau Emirate* (the traditional state/institution in charge of Kaduna) who introduced me to the local community leaders in Badarawa, Malali and Kawo (the study area) – which are locally known as *Mai–anguwa*, a word in the local Hausa language that could loosely be translated as the *Head of a Neighbourhood*.

The meetings I had with those community leaders usually began with me introducing myself as a staff of URP–ABU who is undertaking a

PhD research project concerned with the study area. We then discussed about the fieldwork tasks that were involved in the project and how the data from such would be used. All those that I have met were very welcoming and have also commended the effort I was making. It was very vital to secure the support of those community leaders, or at least make them aware of the project, particularly at a time when security concerns were understandably high.

To ensure a quick response to any safety concerns during the fieldwork, all enumerators were provided with the supervisors' mobile phone numbers and were strictly instructed to make immediate contact in the event of any emergencies. Additionally, a WhatsApp chat group was created to facilitate open communication between enumerators and to share any unique experience that one encounters during the fieldwork. This chat group has also provided a platform for real-time reporting as the fieldwork progressed. A screenshot of the WhatsApp chat group is shown in Figure 3.6.



Figure 3.6: Screenshots from the project's WhatsApp group

As can be seen in the above screenshot (on the left panel), an enumerator, who has asked for direction on how to get to a particular location, was provided with a help by another enumerator. As a form of motivation (it was also fun), we created a league table based on the number of returned (completed) questionnaires by each enumerator as the fieldwork progressed. This league table (on right panel), which was being updated on the WhatsApp group at the end of every day, has created an enjoyable competition amongst enumerators that ultimately aided the timely completion of the exercise.

The materials used during the fieldwork were provided to each enumerator in a plastic portable folder (see Figure 3.7). This comprised printed satellite images (paper maps that cover all areas assigned to the enumerator), BEI forms, survey questionnaires, printed survey guidelines, a digital camera (some enumerators used their smartphone's camera), as well as writing materials such as pencils, pens, eraser, and a jotter. The number of questionnaires given to each enumerator was limited to 30 per day. Each enumerator was expected to administer one questionnaire every 15 minutes and work between seven and eight hours a day. This estimate was set based on the experience gain during the pilot survey that was conducted prior to the main fieldwork (detailed below).



Figure 3.7: The survey instruments

Pilot survey

A pilot survey was conducted five months prior to the main fieldwork, between the 13th and 17th December 2013. The goal of this exercise was twofold – one, to test the applicability of the BEI data collection method and also to test the survey instrument (the household and crime victimisation questionnaire) in the settings of the study area – the other was to identify any aspects of the fieldwork that would require further enhancement. A part of Malali area, which represents around 10% of the total land area of the study site (and has all the three distinct residential neighbourhoods) was selected as the pilot site (see Figure 3.8).

The pilot survey was conducted by five enumerators (all from URP–ABU) and supervised by a colleague who is based in the area as I was in London at the time. As can be seen in Figure 3.8 (see next page), the pilot site was divided into twelve map sections and paper maps were produced for each section. These were used for the field mapping and the BEI surveys – a total of 1,665 properties were identified. Of those, 100 were selected for the household and crime victimisation survey. The data collected were later processed in a GIS environment. It is important to note that this pilot survey was conducted prior to the recruitment and training of enumerators described earlier, although clear instructions were given. In fact, some of the lessons learnt from this exercise, as discussed below, informed the final recruitment and training exercise.

Although the pilot exercise was not without challenges, all the survey methods were clearly feasible, and would work even better with some minor adjustments. The lessons from the pilot survey, which were valuable input in the preparation for the main fieldwork, include:

- The need to inform local community leaders about the fieldwork as many respondents have asked whether authorities were aware of the exercise

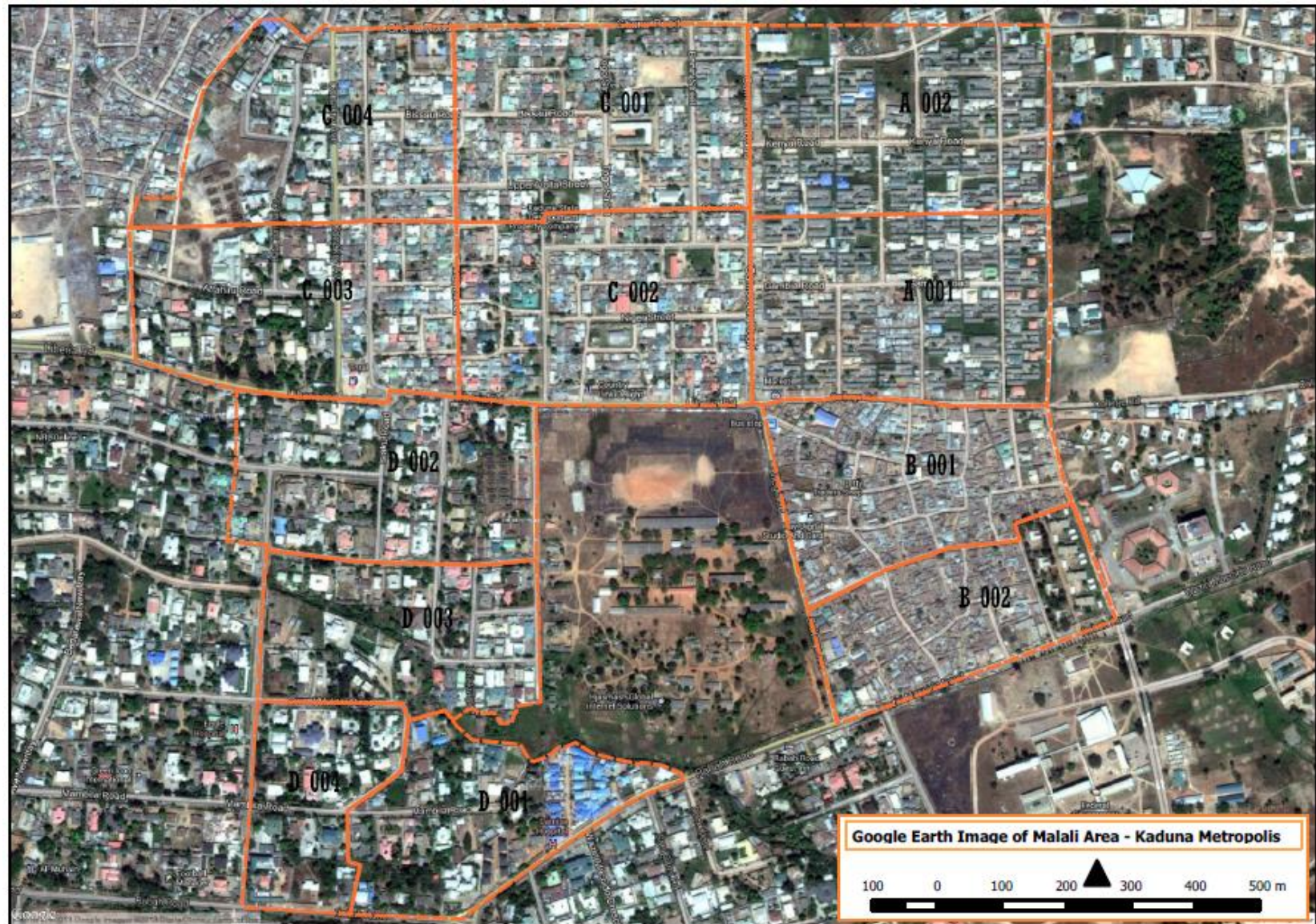


Figure 3.8: Google Earth image of the pilot site

- Enumerators could administer an average of four questionnaires per hour, an average that was used to estimate the period needed to complete the main fieldwork
- The initial plan for self-administered questionnaire was not feasible as many respondents choose to be interviewed instead
- Interviewing household heads for the victimisation survey, which was also the initial plan, was not feasible as majority were not at home during the period of the exercise. We changed the target during the main fieldwork to any adult member who would indicate his/her relationship to the household head.
- There was variation regarding how enumerators rate features of the built-environment. Thorough training (and perhaps demonstration) would be needed prior to the main fieldwork in order to achieve inter-rater consistency.

3.4 Fieldwork and Summary of Data

The fieldwork began on the 18th of April and lasted for 6 weeks (including a 10 days break). Enumerators were paired to work as teams of two persons each throughout the fieldwork. These teams

were divided into two groups with each assigned to one supervisor. Field mapping and BEI exercise were simultaneously undertaken to identify, map, and assign reference number to each property in which the sample for the household and victimisation survey was drawn. This was followed by fieldwork validation (of the BEI exercise) before the commencement of the household and crime victimisation survey. Each of these processes, and the summary of the data that were collected, is detailed below.

Field Mapping

Prior to the BEI and victimisation survey it was necessary to produce a base map of the study area. This was generated using satellite images. For convenience, the study area was divided into 88 map sections, and a paper map produced for each (see Figure 3.9 for a sample of one map section). Enumerators conducted site visits and used pencils to trace out the boundaries (and also indicated the entrance point) of all properties on the paper maps so as to best reflect the actual boundaries (and entrance point) of a property as observed in the field. A unique reference number (URN) was assigned to each property (recorded on the paper map as shown in Figure 3.9) to allow the integration of all datasets in a Geographical Information System (GIS) environment.



Figure 3.9: An example of a paper map showing one of the 88 sections of the study area (all maps were printed on an A3 paper)

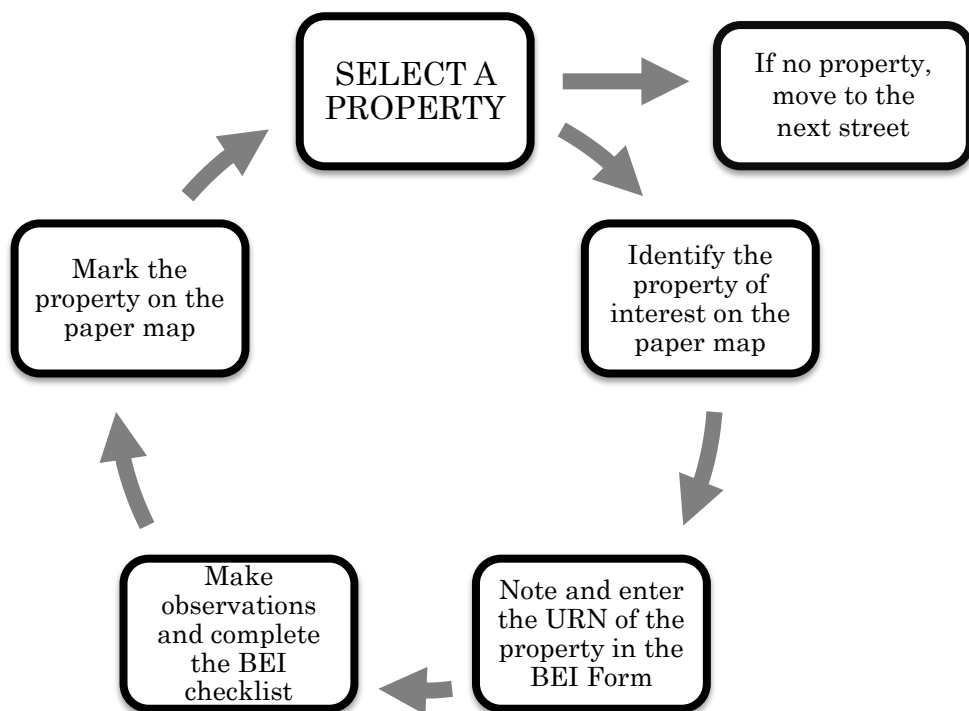
The boundaries produced (and associated URNs) were subsequently digitized in QGIS 2.0 with the aid of the Google Satellite OpenLayers plugin.

Block Environmental Inventory (BEI)

A BEI is a procedure used to objectively assess the physical environment of properties and the street-blocks on which they are located through independent observation. This method has previously been used in studies of crime to measure characteristics of the physical environment (see: Perkins et al., 1992; Brown et al., 2003; Perkins et al., 2009). Informed by previous work, a structured BEI form was produced (see Appendix A) specifically to collect five different categories of datasets. These data are concerned with land use; occupancy status; other non-residential uses; type of building; and access control and target hardening features.

To complete the exercise, enumerators were sent to the field to observe and record the attributes associated with each property identified during the mapping exercise. A standard procedure for undertaking this exercise was designed with the intention of minimizing the chances of error in recording information, to avoid missing some properties for instance. Flowchart 3.1 is a graphical representation of this process.

Flowchart 3.1: The Block Environmental Inventory process



As shown in Flowchart 3.1, the procedure followed in completing the BEI exercise was very simple and straightforward. It begins with selecting a property of interest – enumerators were advised to start this selection from the first property on the right hand side as they enter into a street – so that the property opposite will be the last. The property of interest is then identified on the paper map, and the URN of such property entered on the BEI form. The checklist concerned with all features of interest is then completed. Before an enumerator goes to the next property, he would put a tick (with a red pen) close to where the URN of the property was written on the paper map. This process was repeated until all properties on a street were covered before moving to the next street. A total of 13,687 properties were identified and BEI recorded.

The content and summary of the BEI

Land Use

Observations were made to check whether a property was mainly residential dwelling; mixed–residential (residential dwelling and other purposes e.g. trading); commercial use (e.g. a provision store); public use (e.g. mosque, church, office); school; light industry such as a bakery; workshop such as mechanic garage; recreation spot such

as a bar or football viewing centre; or other land uses such as GSM mast location. Table 3.2 shows the distribution of these land uses.

Table 3.2: Distribution of landuse

Type of Use	No. of properties	Percentage (%)
Residential	10,214	74.63
Residential (Mixed)	2,480	18.12
Commercial	140	1.02
Public	300	2.19
School	87	0.64
Light Industry	25	0.18
Land	187	1.37
Workshops	16	0.12
Recreational	28	0.20
Others	66	0.48
No data	144	1.05
Total	13,687	100%

Occupancy Status

The status of every plot/property was observed and recorded. Enumerators checked for any sign that would suggest people live in a property of interest or any activity that indicates the property is in use (occupied). If not, we check whether such property is vacant, an abandoned building (for example: a property with collapsed roof), or property under construction. The summary for the status of residential properties across the study area is presented in Table 3.3.

Table 3.3: The occupancy status of residential properties

Occupancy	No. of properties	Percentage (%)
Occupied	12,190	96.03
Construction/occupied	334	2.63
Abandoned Building	114	0.90
Vacant	56	0.44
Total	12,694	100.00

Mixed-residential landuse

It is a common practice in Nigeria for non-residential activities (usually petty trading) to exist within a residential dwelling. We observed whether these land uses exist within properties. This could be a shop (a permanent structure attached or built as part of the property that is used for non-residential purposes such as a barbers shop or a provision store); kiosks (a non-permanent structure usually made from wood or zinc located in front of a property for the purpose of non-residential activity such as GSM recharge cards trading); in-house trading such as selling household items or chilled drinking water; or outside trading (see Figure 3.10). Table 3.4 shows the types of non-residential activities in the mixed-residential properties. It should be noted that some properties may have more than one non-residential activity, for instance, having a shop and a kiosk or in-house trading at the same time.



Figure 3.10: A food vendor selling outside a residential dwelling

Table 3.4: The mixed–residential land use

Type of use	No. of properties	Percentage (%)
Shops	1,433	57.78
Kiosk	431	17.38
In–trading	360	14.52
Out–trading	693	27.94

Type of building

Three characteristics of properties were assessed – whether it is a flat or storey building – whether the building is attached or detached (summary not presented here) – and whether the property was built with cement, mud, or temporary building material. The summary for these property characteristics are presented in Table 3.5 and 3.6.

Table 3.5: The type of residential property

Type of Property	No. of properties	Percentage (%)
Storey	501	3.95
Flat	12,193	96.05
Total	12,694	100.00

Table 3.6: The building material use in residential property

Building Material	No. of properties	Percentage (%)
Cement	11,728	92.39
Mud/Temporary	965	7.61
Total	12,694	100.00

Access control & target hardening

The final features of interest recorded during the BEI exercise were physical features of a property, specifically the access control and target hardening elements. Figure 3.11 shows a property with some of these features. The distribution of all features of interest is shown in Table 3.7, and each is described below:



Figure 3.11: A house with access control & target hardening – A) security bars; B) security light; and C) gate

- *Security bars*: this term refers to any kind of barrier (in addition to fence) that would make breaking into a property more difficult. It can be in the form of barbed wire as shown in Figure 3.11 (A), sharp iron rod, or broken bottles fixed at the top of a fence.
- *Gate*: this feature is shown in Figure 3.11 (C). Any property that the entrance is through a gate is classified as “drive-in” housing, meaning that a motor car can be parked inside.
- *Security lights*: this refers to any lighting facility that is fixed to the external wall of a property. It is important to note that the survey was conducted during the day time – no confirmation regarding whether the security lights are functional or not.
- *Guard*: a guard refers to any human presence at the entrance of a property that was purposely meant to control access into a dwelling. This includes the presence of a civilian guard (locally known as *Mai-guard*), professional private security guard, paramilitary, and so on.

- *Danger warning*: this is any warning sign at a property that indicates danger – for example, *Beware of Dog*, *Keep-off Military Zone*.
- *CCTV*: this refers to a Close-circuit television device, a video recording device usually installed to monitor the movement of people in and out of a property.
- *Dogs*: the presence of a dog was recorded only when an enumerator sighted one within in a property or when there was a clear sign indicating the presence of dog, for example a dog barking or a warning sign such as *Beware of Dog*.

Table 3.7: Access control and target hardening features

Feature	Yes	No	Yes (%)	No (%)
Security bars	2,976	9,718	23.44	76.56
Gate	6,733	5,961	53.04	46.96
Security Light	6,219	6,475	48.99	51.01
Security Guard	854	11,840	6.73	93.27
Danger Warning	269	12,425	2.12	97.88
CCTV	10	12,684	0.08	99.92
Dog	243	12,451	1.91	98.09

Some other access control and target hardening elements that were part of the BEI exercise but have not been presented here are:

- *High wall*: this is defined as any fence that is above 2.5 metres high. The estimation of this measurement is based on the perception of the enumerator. During the BEI validation exercise, we noticed a significant variation in how enumerators measured a high wall. Hence, this element was not included in any analysis that is presented in this thesis.
- *Garage*: we noticed from the data that very few (around 4%) residential properties have garage, and of those, 62% also have a gate. This element was not included in the analysis.
- *Outdoor sitting*: this refers to people sitting in front of a residential dwelling to socialise with neighbours or friends. It is a commonplace in Nigeria to see a permanent facility (locally known as *Dakali* – see Figure 3.12) or a wooden bench placed in front of a dwelling for this purpose. What we found during the BEI validation exercise, however, was that an enumerator would observe and record outdoor sitting in a property but by the time a supervisor go for validation, no one would be found. The explanation to this is that when the two exercises were conducted at different times of the day (morning, afternoon or evening) or different days or the week (e.g. week day and week end), those who were sighted sitting

outside would perhaps be elsewhere (for example: at work or school). Consequently, the data regarding outdoor sitting was not used in this thesis.



Figure 3.12: Outdoor sitting on *Dakali*

- *Open door access:* another common practice in Nigeria, particularly in unplanned neighbourhoods, is that dwellings would be open in the morning and remain unlocked until bedtime unless if no one is at home (see Figure 3.13). The complexity in observing this practice was similar to that of outdoor sitting. It's only when people are at home, for instance, that dwellings are left unlocked. These data were also not used in this thesis.



Figure 3.13: Example of an unlocked residential dwelling

The records from the BEI exercise were entered into a spreadsheet and later “joined”, based on the URN values, to the spatial data generated from the mapping exercise.

Household and Crime Victimisation Survey

This section begins with a discussion on the sampling techniques adopted for this survey followed by the description of the questionnaire content and the summary of response from the participants. A 44-item structured questionnaire interview was developed to collect data regarding household characteristics and crime victimisation (See Appendix B).

Sampling

The total population from which the sample for this survey was drawn is 12,524 residential homes. Those were the properties identified as residential or mixed–residential land uses (being occupied, not vacant or abandoned) during the mapping and BEI exercises described earlier in this chapter. The survey targeted a sample size of 3,131 households – 25% of the total population. It is important to note that, in contrast to most cities in the developed world, in Nigerian households may be home to 25 or more people, and several families (more than five) may live in the same housing unit. Such houses were considered as one unit.

To achieve the target sample size, houses were selected from within the population using systematic random sampling, whereby one adult of every 4th household (within a street segment) was approached to participate in the survey. The starting point on any street segment was randomly selected from within the first four houses to ensure that every household has equal chance of being selected. In some cases, selected samples were replaced with the household next to such sample – the reason for this was largely because nobody was at home during the survey period. Although no note was taken regarding the rate of sample replacement, which is

regrettable, this did not occur frequently based on the discussions I had with the enumerators.

A total of 3,294 households were interviewed (163 households more than the target sample) but only those data from 2,932 of the surveys were included in this thesis – 105 responses were rejected either because no URN was recorded, or because the URN duplicated an existing record. The remaining surveys (257) were rejected because respondents declined to respond to most (or all) questions during the interview. This means that there was a non-response rate of 7.8%, and of all those households approached, data were available for analysis for just under 90% of homes. With such limited attrition, the data analysed in this thesis are representative of the local population from which the sample was drawn.

Content of Questionnaire and Data Summary

The questionnaire for the household and crime victimisation survey was structured into four sections (see Appendix B). Eleven questions (Section 1) related to demography such as ethnicity and household structure, ten questions (Section 2) concerned respondent's perception of safety and relationship with neighbours, and 12 each (Section 3 and 4) concerned respondents' and neighbours' victimisation experience. Where possible, the questions used were

taken from existing surveys to avoid asking any wrong or inappropriate questions that would consequently produce misleading responses, an issue that has been noted in Nigeria. For instance, here is what the statistician general of the National Bureau of Statistics (NBC) of Nigeria was reported to have said with regards to asking the wrong questions in a survey.

“When people are asked how much they earn, suspicion of authority makes them underestimate. Ask them how much they spend, however, and, chest puffed up, they will give a much higher number. In surveys, getting the question right matters.”

(Pilling, 2016)

To complete the survey, an enumerator would approach a selected participant, in which upon acceptance to participate, would first of all agree to a consent statement (written at the top of the questionnaire) before proceeding with the interview. At this point, the property of the respondent would be identified on the paper map that was generated during field mapping and the URN of such property noted on the questionnaire. During the interview, the enumerator would read out each question (translated to the local language if such was needed) and the response to each question would be noted on the questionnaire. To help respondents remember

the period of incidents, enumerators would refer to major events that had occurred about a year ago (for example: democracy day celebration, Ramadan fasting and Eid festivals). Upon completion of the interview, the enumerator would issue a survey acknowledgement card to the participant (detailed in Section 3.5), file the completed questionnaire, and then move to the next selected participant. The content of each section of the questionnaire and the summary of responses are detailed below:

Section A – Demographic Characteristics

The type of questions asked in this section are a commonplace in the social science related surveys including those concerned with crime victimisation. These questions produced baseline information regarding the socio-demographic characteristics of the sampled population. The questions asked in this present survey were:

Are you the household head?

Respondents were asked to indicate with either a *Yes* (if they are the household heads) or a *No* (if they are not – in which they specify their relationship to the household head). This question was added after it became clear during the pilot survey that very few household heads would be available for the interview. The aim was to take note

of whether a respondent was the head or another member of the household that could be capable of providing reliable information.

Gender, Age, and Ethnicity

The question regarding *Gender* had two options; *Male* or *Female*. The question regarding *Age* was left open (not choosing from a range) – respondents were asked to specify their exact age (i.e. at last birthday). Similarly, no closed option was provided for the question regarding ethnicity – respondents were asked to specifically provide their ethnicity. As mentioned earlier in this chapter, Nigeria is a multi-ethnic society with over 300 different tribes. Collecting information about ethnicity (or tribe) will make it much easier to categorize respondents into broader ethnic groups during analysis. About 94% of respondents have provided information about their ethnicity, which has been summarised in Table 3.8.

Occupation and Employment Level

Respondents were asked about their occupation – whether they are working in the civil service (such as government department); private organization (such as bank); are a craftsman (for example: carpenter, mechanic); trader; farmer; student; retiree; unable to work; unemployed; or others which should be specified. The level of employment was also asked – which could be an executive; manager;

expert; intermediate; trainee; large business proprietor; small business proprietor; or others (which is to be specified).

Table 3.8: Ethnicity of respondents

Ethnicity/ Tribe	Number	(%)	Ethnicity/ Tribe	Number	(%)
Adara	1	0.036	Jarra	1	0.036
Afenmer	1	0.036	Jukkun	1	0.036
Alagon	1	0.036	Kabba	1	0.036
Amawa	1	0.036	Kadara	5	0.181
Angas	3	0.109	Kaguma	5	0.181
Atilo	1	0.036	Kandal	1	0.036
Attakar	1	0.036	Kanuri	76	2.752
Baachi	1	0.036	Karekare	2	0.072
Babur	101	3.657	Katab	31	1.122
Bajju	10	0.362	Kilba	2	0.072
Bassa	2	0.072	Kurama	3	0.109
Birom	2	0.072	Kwalla	1	0.036
Buzu	12	0.434	Mada	2	0.072
Chachiya	2	0.072	Mangu	1	0.036
Chanba	1	0.036	Margi	66	2.390
Chawai	1	0.036	Marwa	1	0.036
Chibok	1	0.036	Miango	2	0.072
Darma	1	0.036	Mungawal	2	0.072
Edo	2	0.072	Nupe	63	2.281
Egbira	60	2.172	Okon	1	0.036
Etsawo	1	0.036	Pero	7	0.253
Fulani	194	7.024	Sanga	1	0.036
Gaanda	1	0.036	ShuwaArab	3	0.109
Gbwagi	45	1.629	Tangale	2	0.072
Hausa	1801	65.25	Tera	1	0.036
Higie	1	0.036	Tiv	5	0.181
Ibilu	1	0.036	Ukulu	1	0.036
Idoma	4	0.145	Waja	3	0.109
Igala	63	2.281	Wurkum	1	0.036
Ikolu	4	0.145	Yangole	1	0.036
Igbo	14	0.507	Yoruba	88	3.186
Ilanlu	3	0.109	Zuru	2	0.072
Jaba	42	1.521	Total	2,762	100

For how long have you lived at this address?

Respondents were asked to indicate the period they have lived at their present address – over 98% of participants have responded to this question. The summary of responses is presented in Table 3.9.

Table 3.9: Period living at present address

Living At this Address	No. of Households	Percentage (%)
Less than 1 year	162	5.61
Between 1 – 2 years	151	5.23
Between 2 – 5 years	545	18.87
More than 5 years	2,030	70.29
Total	2,888	100.00

Tenancy type

Two types of tenancy are common in Nigeria – one is owner occupier and the other is rented accommodation. Respondents were asked to indicate which of these tenancy types best describe their status. A third option was to report others, where in such case respondents would be asked to specify the type of tenancy. More than 95% of respondents have answered this question. Table 3.10 provides the summary of all responses.

Table 3.10: Type of tenancy

Tenancy Type	No. of Households	Percentage (%)
Owner occupier	2,021	72.39
Rented	771	27.61
Total	2,792	100.00

Type of living, Number of families and Family size at this address

As has been discussed earlier in this chapter, in Nigeria and perhaps some other places across sub-Saharan Africa, a household may be home to 25 or more people, and several families (more than five) may live in the same housing unit. To capture this, respondents were asked about the type of living in their present address. Almost all the respondents (more than 99%) have responded to this question. Following on it, respondents were also asked to indicate the number of families and the sizes of such families living in their present address. The response rates for these questions were about 97% and 91% respectively. The summary for these questions are presented in Tables 3.11, 3.12, and 3.13.

Table 3.11: Type of living

Type of Living	No. of Households	Percentage (%)
Single Family	2,105	72.31
Single Person	29	1
Compound Sharing	591	20.30
Extended Family	186	6.39
Total	2,911	100.00

Table 3.12: Number of families living at each address

Number of families	No. of Households	Percentage (%)
1	2,053	72.09
2	280	9.83
3	177	6.22
4	91	3.20
5	44	1.54
More than 5	203	7.13
Total	2,848	100.00

Table 3.13: Size of household

Household Size	No. of Households	Percentage (%)
1 – 5	371	13.92
6 – 10	1,132	42.48
11 – 15	573	21.50
16 – 20	306	11.48
21 – 25	144	5.40
More than 25	139	5.22
Total	2,665	100.00

Number of adults living (and those employed) at this address

The final questions in this section asked about the adult members of the household. Respondents were asked to indicate the number of male and female adult(s) living in their homes. This was followed by a question regarding the number of adults that are employed. A question concerning the children members of the household, which some respondents would perhaps considered sensitive, was not included in the questionnaire. However, the response from the two questions concerned with the family size and the number of adults

were used to calculate the number of children. The summary for these data are presented in Tables 3.14 – 3.20.

Table 3.14: Number of adults living at each address

No. of Adults	No. of Households	Percentage (%)
1 – 2	276	9.62
3 – 5	955	33.28
6 – 10	1,038	36.16
11 – 15	391	13.62
16 – 20	123	4.29
21 – 25	47	1.64
More than 25	40	1.39
Total	2,870	100.00

Table 3.15: Number of children at each address

Children	No. of Households	Percentage (%)
0	372	13.97
1 – 5	1,511	56.74
6 – 10	562	21.10
11 – 15	155	5.82
16 – 20	40	1.50
21 – 25	14	0.53
More than 25	9	0.34
Total	2,663	100.00

Table 3.16: Number of male adults at each address

Male Adults	No. of Households	Percentage (%)
0	3	0.10
1	399	13.87
2 – 5	1,776	61.77
6 – 10	571	19.86
11 – 15	95	3.30
16 – 20	25	0.87
21 – 25	1	0.03
More than 20	5	0.17
Total	2,875	100.00

Table 3.17: Number of female adults at each address

Female Adults	No. of Households	Percentage (%)
0	40	1.39
1	654	22.79
2 – 5	1,727	60.17
6 – 10	376	13.10
11 – 15	57	1.99
16 – 20	11	0.38
21 – 25	3	0.10
More than 20	2	0.07
Total	2,870	100.00

Table 3.18: Employed adults at each address

Employment Rate (%)	No. of Households	Percentage (%)
0	73	2.56
1 – 24	414	14.50
25 – 49	1,101	38.56
50 – 74	969	33.94
75 – 99	146	5.11
100	152	5.32
Total	2,855	100.00

Table 3.19: Employed male adults at each address

Male Employment (%)	No. of Households	Percentage (%)
0	105	3.68
1 – 24	80	2.80
25 – 49	488	17.10
50 – 74	1,108	38.82
75 – 99	234	8.20
100	839	29.40
Total	2,855	100.00

Table 3.20: Employed female adults at each address

Female Employment (%)	No. of Households	Percentage (%)
0	1,658	58.71
1 – 24	124	4.39
25 – 49	375	13.28
50 – 74	422	14.94
75 – 99	33	1.17
100	212	7.51
Total	2,824	100.00

Section B – Perception of Safety and Relation with Neighbours

The questions asked in this section were concerned with the perception of safety and the relationship between the respondent and his/her neighbours (those who live on the same street). Many of these questions, although here asked at street segment level, were drawn from the works of Sampson et al. (1997) and Sutherland et al. (2013). Altogether, 10 sets of questions (or in some cases statements) were asked, where respondents were required to indicate what best

described their situation or how much they agree with a statement.

The questions/statements covered include:

- How safe do you feel living on this street?
- How worried are you about being a target of property crime while you are away from home?
- How many of your neighbours do you know?
- How strongly do you interact with your neighbours?
- People act with courtesy to each other in public spaces in this street.
- People in this street can be trusted.
- People in this street are willing to help their neighbours.
- People in this street can be relied upon to act when someone is acting suspiciously.
- Your neighbours will inform you of any suspicious activity around your property.
- How proud are you to live on this street?

It is important to note that the use of “neighbours” here refers to those people who live on the same street as the respondents – street here means both faces of a street block between two road intersections (as defined in Weisburd et al., 2012).

Section C and D – Crime Victimisation

Crime can be classified in different ways – personal or property, violent or non-violent, etcetera. In Nigeria, crime is officially classified as “offences against property”¹² and “offences against person”¹³. Considering the orientation of this current study which is to explore the environmental correlates of crime with a sample of around 3000 households and a timeframe of one year, only certain property crimes were considered (i.e. burglary/theft and automobile crime). Personal crimes were not considered as most are very rare. Moreover, people are less likely to discuss their experience of personal crime in fear of stigma (e.g. domestic violence, rape). Other property crimes such as arson or armed robbery, which are also rare events (e.g. only 10 cases of arson and 40 cases of armed robbery were reported to the police in the whole of Kaduna state in 2007), were not considered to avoid having too few data points for analysis.

The questions asked in these sections, therefore, were related to property crime victimisation experience – these questions were

¹² Offences against property include armed robbery, demanding with menace, theft/stealing, burglary, house-breaking, and store-breaking. Others are false pretence and cheating, forgery, receiving stolen property, unlawful possession, arson and other related offences.

¹³ Offences against person include murder, manslaughter, attempted murder, suicide, and attempted suicide. Others are grievous harm & wounding, assault, child-stealing, slave dealing, rape and indecent assault, kidnapping, un-natural offences, and other related offences.

similar to those asked in the 2012 Nigerian crime victimisation survey (See: Alemika 2013). The questions asked were whether the respondents (in Section C) and their neighbours (in Section D) had experienced some certain types of property crime in the last 12 months. These questions were repeated for incidents that had *ever happened* in a property (excluding those that had happen in the last one year).

Specifically, the survey asked:

Section C

- *In the LAST 1 YEAR, have any of the following incidents HAPPENED within your Property?*
- *Excluding the last 1 year, have any of the following incidents EVER HAPPENED within this property?*

Section D

- *In the LAST 1 YEAR, have any of the following incidents happened at your immediate next door neighbour?*
- *Excluding the last 1 year, have any of the following incidents EVER HAPPENED at your next door neighbours?*

Six types of incidents, as described below, were asked. The summary of responses (see: Table 3.21 – 3.27) and description for each crime type are presented below.

Table 3.21: Summary of all crime incidents (last one year)

Crime type	Households	Percentage	Incidents
Breaking and entering	457	15.6 %	869
Domestic theft	963	32.8 %	2,486
Damage to Property	327	11.3 %	855
Theft of Automobile	265	9.2 %	433
Theft from Automobile	164	5.7 %	261
Damage to Automobile	312	10.9 %	1,365

Breaking and entering (B&E): B&E here refers to an incident of domestic burglary that involves the unlawful break-in into a property with the intention to steal valuable(s).

Table 3.22: Breaking and entering (last one year)

Breaking and entering	Households	Percentage (%)
0	2,475	84.41
1	253	8.63
2	109	3.72
3	49	1.67
4	21	0.72
5	6	0.20
More than 5	19	0.65
Total households	2,932	100
Households with incidents	457	15.59
All Incidents (Inc. repeat)	869	

Domestic theft: this type of incident relates to the illegal removal (or stealing) of valuable(s) from a property without break-in. The difference between this type of incident and B&E is that one does not involve break-in while the other does.

Table 3.23: Domestic theft (last one year)

Domestic Theft	Households	Percentage (%)
0	1,969	67.16
1	348	11.87
2	250	8.53
3	177	6.04
4	100	3.41
5	34	1.16
More than 5	9	1.84
Total households	2,932	100
Households with incidents	963	32.84
All Incidents (Inc. repeat)	2,486	

Damage to property: this type of incident refers to any wilful damage to one's property (for example: graffiti).

Table 3.24: Damage to property (last one year)

Damage to Property	Households	Percentage (%)
0	2,570	88.71
1	129	4.45
2	81	2.80
3	54	1.86
4	27	0.93
5	10	0.35
More than 5	26	0.90
Total Households	2,897	100
Households with Incidents	327	11.29
All incidents (Inc. repeat)	855	

Theft of automobile: automobile here refers to a motor vehicle. This incident is when an automobile is stolen.

Table 3.25: Theft of automobile (last one year)

Theft of Automobile	Households	Percentage (%)
0	2,621	90.82
1	172	5.96
2	58	2.01
3	20	0.69
4	5	0.17
5	3	0.10
More than 5	7	0.24
Total households	2,886	100
Households with incidents	265	9.18
All incidents (Inc. repeat)	433	

Theft from automobile: this incident refers to stealing of valuable(s) from an automobile.

Table 3.26: Theft from automobile (last one year)

Theft from Automobile	Households	Percentage (%)
No incident	2,715	94.30
1	114	3.96
2	32	1.11
3	8	0.27
4	4	0.14
5	2	0.07
More than 5	4	0.14
Total households	2,879	100
Households with incidents	164	5.70
All incidents (Inc. repeat)	261	

Damage to automobile: this incident is similar to damage to property only that here the target is motor vehicle.

Table 3.27: Damage to automobile within (last one year)

Damage to Automobile	Households	Percentage (%)
0	2,563	89.15
1	79	2.75
2	68	2.37
3	65	2.26
4	20	0.70
5	6	0.21
More than 5	74	2.57
Total households	2,875	100
Households with incidents	312	10.85
All incidents (Inc. repeat)	1,365	

3.5 Fieldwork Validation

One genuine concern regarding surveys in Nigeria, and perhaps across sub-Saharan Africa, is that enumerators could duplicitously fill in survey forms without going to the field. Addressing this concern would ultimately improve the reliability of any data collection process in such settings. For instance, the statistician general of the NBC – Yemi Kale – as recently reported in the Financial Times, had employed GPS technology to monitor the movement of enumerators during surveys.

“Mr Kale cannot take much at face value. He even checks his workers’ movements through GPS. Otherwise, staff may be tempted to sit at home and make up the numbers.”

(Pilling, 2016)

As mentioned earlier in this chapter, the enumerators that participated in the fieldwork that was reported here were either graduates or undergraduate students. Additionally, I have taught some in the university and could write them a reference. But with that genuine concern in mind (as discussed above), however, the fieldwork reported in this thesis has been validated using two methods – one was concerned with the BEI exercise and the other with the household and victimisation survey.

The first validation exercise was in the form of site visits by the two supervisors to assess the correctness of the data collected during the BEI exercise – all enumerators were made aware during the fieldwork training that this verification exercise would be conducted. The survey followed this form – for each map section, a 5% sample was randomly selected from the BEI record (as the control data) – a supervisor would visit the selected sites to re-observe and complete a new BEI form – the new records were then compared to the initial ones – the rate of accuracy for each component of the BEI was

computed. A total of 685 properties were re-observed – Table 3.28 shows the summary for accurate assessments regarding each component of the BEI.

Table 3.28: Summary of BEI validation exercise

BEI Component	Rate of Accuracy (%)
Land use	98.74
Occupancy status	96.72
Building type (flat/storey)	100
Building material	100
Security bars	98.02
Gate	100
Garage	100
High wall	64.48
Security light	96.81
Outdoor sitting	37.05
Open access	71.19
Security guard	98.65
Danger warning	98.01
Dog	68.49
CCTV	100

The second validation exercise was not aimed at verifying the information provided by the respondents during the household and victimisation survey. Instead, it was simply to ascertain whether enumerators have interviewed a home or not. As has been mentioned earlier in the chapter, every household that participated in the survey was issued with a survey acknowledgement card (see

Figure 3.14). Each participant was advised to keep the card safe (as someone will come to collect it) and also inform the adult members of the household where the card is kept in case he/she would not be around during collection.

Survey Acknowledgement Card

Ref Number:

Thank you for participating in this survey. We will appreciate if you keep this card with you as another enumerator will be coming within days to verify the exercise.

Once again, thank you!

Figure 3.14: The survey acknowledgement card

To complete the exercise, a 10% sample was randomly selected from the questionnaires returned by each enumerator – totalling 320 households across the whole sample. A supervisor would approach those selected households to demand for the survey acknowledgement card. Of those selected households, around 67% have provided the cards, 21% have acknowledged that the survey was conducted in the household but either the person holding the card was not available at the time of visit or the card was not found, 9% have also confirmed their participation in the survey but denied

collecting any card, while less than 3% were either not sure or said they weren't interviewed.

3.6 Final Reflections

There are two dimensions to collecting data (i.e. crime, socio-demographic, and spatial data) for research purpose conducted in settings of a typical developing country such as Nigeria. On the one hand, as highlighted in this chapter, secondary data are mostly incomplete, unreliable, or inaccessible. On the other, primary data collection is not always a straightforward undertaking – it presents a unique set of challenges. Some of these challenges, as demonstrated here, appeared to be resolvable while others seemed extremely intractable. This final note reflects on these issues with the aim of making future research aware and suggesting possible ways in which such challenges could be addressed.

Considering the issues associated with secondary data first, with respect to the crime data, in studies conducted in the developed world, official police records are commonly used to estimate rates of crime. Such data are rarely available for the purposes of research conducted in the developing world, ruling out the analysis of such

secondary data sources. Even if such data were readily available, the scale of the under-reporting of crime to the police in Nigeria is substantial. As a result, it is likely that police data would represent a biased sample of offenses (Sherman et al., 1989), the analysis of which would likely lead to errors of statistical inference. Although under-reporting is a concern in most countries around the world (Shaw et al., 2003; Sidebottom 2015), a study of criminal victimisation across the industrialized world suggests that almost all burglary incidents are reported to the police (Van Dijk and Mayhew, 1993). This minimizes reporting bias for analyses conducted in these countries. If under-reporting is a particular problem in developing countries such as Nigeria, however, care will need to be taken in studies that involve the analysis of police recorded crime data.

Additionally, unlike in the developed world, Nigerian police data are not available in digital form. While problematic for this research, the development of systems to capture such data in the future may provide opportunities to collect data, particularly spatial data, which are actually more accurate than that recorded in other countries. For example, in the UK and the US, crimes reported to the police are (typically) initially recorded in a text format, and subsequently geocoded using GIS. However, with the proliferation of GPS

technology, which is now embedded into most mobile devices, it seems plausible to suggest that spatial data could be more directly captured either by the police or victims of crime.

In developed countries, large-scale sample surveys provide an alternative to police crime data. However, more often than not, such data are not available in developing countries such as Nigeria. On a related note, nor are population data for units of analysis that would facilitate the types of analysis common in studies of environmental criminology. The issues discussed above were addressed in this PhD project by conducting a household and victimisation survey, and a BEI. Future research might use similar methods, perhaps taking advantage of the opportunities that mobile data capture devices provide. To improve on the usability of population data for research purposes, the population agency in Nigeria might consider collecting (and also publishing) data for future censuses at smaller area units.

A field mapping exercise was conducted as part of this PhD project to address the paucity of spatial data. While this method seemed feasible and reliable, huge resources would be required to apply such in a study that is concerned with larger geographical area. As new and improved web-based mapping platforms continue to emerge, some of which are freely available anywhere around the world,

Volunteered Geographic Information (VGI, see Goodchild, 2007) could be a viable source of spatial data. The use of this data source for research, however, has been limited owing to concerns regarding quality (Haklay, 2010). An organized (controlled and monitored) VGI project could reduce such concerns. For instance, “Map Kibera”, a slum mapping project in Nairobi Kenya (see Hagen, 2011), is a typical example of how committed volunteers can map and distribute accurate spatial data about their community.

Considering the issues associated with primary data collection in settings of a typical developing country such as Nigeria, there are some circumstances that could lead to partial or complete abandonment of surveys. In the fieldwork reported in this chapter, two such circumstances or rather incidents had occurred during the field mapping and BEI surveys that are noteworthy. First, an enumerator was prevented (and also harassed) by some military guards from mapping an area that hosts a number of houses belonging to serving and retired senior military officers. As the guards claimed, regardless of whether the police and or community leaders were aware of the project, permission must be granted by the military authorities before any such project is conducted around the area.

The second incident involved a landlord who claimed to own much of the properties around a particular part of the study area. This person prevented enumerators from mapping the area as he suspected that they were agents of “land grabbers” (a notorious gang that extort land and property owners), seeking information that would facilitate the sales of his properties. Land grabbing, an act of illegally re-selling land or property by someone other than the rightful owner, is a commonplace in some part of Nigeria. All efforts to make the person understand that the enumerators were not what he perceived them to be did not work. In fact, he invited local thugs to the scene, which led us to abandon the survey of the affected area for safety reasons.

Other issues regarding primary data collection in places like Nigeria is resource constrain. Fieldworks of the kind reported in this chapter requires huge funds particularly if it will cover a large geographical extent (e.g. whole of Kaduna). As discussed in this chapter, employing student volunteers as enumerators may reduce the cost of data collection for research in settings such as Nigeria. However, a local network is essential to securing such participation of volunteers. As demonstrated throughout this chapter, aside volunteering, working with local partners would help to resolve

some of the most extreme situations that could affect the success of a survey exercise.

Finally, as mentioned in the introduction, the data collected during the present fieldwork has afforded this research project with a variety of options regarding what line of enquiry should be taken. In the next three chapters, I will demonstrate how part of the data were used to test the applicability of Euro–American theories of crime in settings of Nigeria.

Chapter 4

Crime Concentration at Places

Research into “crime at places” is not new (e.g. Pierce et al., 1988; Sherman et al., 1989; Weisburd et al., 2004). The term is coined by Eck and Weisburd (1995) to refer to the growing literature concerned with the study of crime at the micro-level of place. A micro place in this context refers to a very small area such as individual buildings, addresses, or street segments. The other level of place considered in this chapter is the meso-level, an area such as a neighbourhood. Research consistently demonstrates that urban crime concentrates at micro-places (see for example Pierce et al., 1988; Sherman et al., 1989; Eck et al., 2000; Weisburd et al., 2004; Johnson, 2010; Johnson and Bowers, 2010; Braga et al., 2011; Weisburd et al., 2012; Weisburd and

Amram, 2014; Bowers, 2014; Curman et al., 2015). David Weisburd refers to this as the “law of crime concentration at places”. The law states that *“for a defined measure of crime at a specific microgeographic unit, the concentration of crime will fall within a narrow bandwidth of percentages for a defined cumulative proportion of crime”* (Weisburd, 2015: p.138). To put it differently, a high proportion of urban crime will concentrate at very few micro-places.

At the 2014 Sutherland lecture (see: Weisburd, 2015), David Weisburd emphasized the need for wider empirical testing of the above mentioned proposition – raising an interesting question – are there circumstances or contexts for which this law does not apply? Much of the published research on this issue, however, has focused on Euro-American cities (with few exceptions – for example: Weisburd and Amram, 2014; Mazeika and Kumar, 2016). Countries such as Nigeria have attracted little or no research attention – in fact, no study that I am aware of has examined patterns of crime concentration at micro-places within the cities of sub-Saharan Africa. The urban environment and socio-cultural settings in sub-Saharan Africa differ greatly from Euro-American cities. Consequently, it is unclear if the law of crime concentration at places will apply in this context – this chapter attempts to address such gap.

Using data from the BEI and crime victimisation surveys described in Chapter 3, the distribution of two crime types – breaking & entering (B&E) and domestic theft – at individual households, street segments and neighbourhoods are analysed here. At the point level (household), Nearest Neighbour Analysis (NNA) is used to statistically test whether crime is spatially clustered more than would be expected by chance, as observed in studies conducted elsewhere (e.g. Johnson and Bowers, 2010; Johnson, 2010; Hepenstal and Johnson, 2010; Davis and Johnson, 2015). Lorenz curve and the Gini index (GI) are used to examine whether crime concentrates at different spatial scales (street segments and neighbourhoods), if such clustering reflects anything beyond the pattern observed at the household (point) level, and whether the clustering at the micro-level (i.e. street segments) can explain the pattern at the meso-level of place (neighbourhoods).

This chapter extends the existing literature on the concentration of crime at places in two dimensions. First, the focus is on an understudied region (sub-Saharan Africa) where, unlike Europe and America, cities often develop with little or no centralized physical planning. Second, datasets from a victimisation survey are used as an alternative to the traditional police crime incident report that has been typically utilized in previous studies of crime at places conducted in Europe and America. The chapter is organized as follows: the next

section provides an overview of existing research on the concentration of crime at places. This will set the theoretical context upon which the findings to be presented here will be discussed. A discussion on the appropriate spatial unit of analysis in the study of crime at places follows. The next section presents a description of the data used here and the spatial units of analysis. Finally, the findings are presented and discussed against the background of the existing literature on the concentration of crime at places.

4.1 Concentration of crime at places

As discussed in Chapter 2, interest in the study of the geography of crime dates back to the 19th century – in 1829 for instance, Andre–Michel Guerry and Adriano Balbi studied variation in rates of crime across large administrative regions of France (Weisburd et al., 2009). In the latter part of the 19th century, European scholars continued to explore the geography of crime using large areal units (for example see: Glydes, 1856). A turning point in this quest came from the works started in the 1920s across the Atlantic, at the Chicago school, which shifted the focus from considering larger geographical units, to exploring variations in rates of crime across urban neighbourhoods, a meso–level of place (see: Burgess, 1925, Shaw and McKay, 1942). As

will be discussed in the next section, in recent years, the focus has been on micro-level of places such as addresses and street segments.

Regardless of the geographic unit of analysis considered, previous research has not found crime to be evenly distributed across space – it varies across meso-places such as neighbourhoods (see: Shaw and McKay, 1969; Sampson et al., 1997), and at the micro level of place such as the street segments (see: Weisburd et al., 2004; Weisburd et al. 2012; Weisburd and Amram, 2014) or addresses (see: Pierce et al., 1988; Sherman et al. 1989; Eck et al., 2000). It is also worth noting that, as research on crime at places continues to evolve, the importance of analysing crime patterns at micro-places has been demonstrated through empirical studies established over the years that show crime clusters (Andresen and Malleson, 2011).

The degree to which crime concentrates at micro-places within cities has gained considerable research attention in the last 25 years, largely inspired by the seminal work of Lawrence Sherman and colleagues. Sherman et al. (1989) studied a year-long record of emergency calls to the police in the city of Minneapolis, US. Although they found around 60% of addresses in the city generated all the emergency calls, only 3.5% of addresses produced 50% of all calls. The concentration of crime was found to be even greater when the patterns observed for specific

crime were analysed separately. In the case of predatory crimes for instance, all robbery, auto thefts and rape or criminal sexual conduct (CSC) related calls were generated from only 2.2%, 2.7%, and 1.7% of all places respectively. This research provided startling evidence to suggest that crime is not only unequally distributed across space but is also highly concentrated at few micro-places.

In a longitudinal study of crime across street segments in the city of Seattle, US, Weisburd et al. (2004; see also Weisburd et al., 2012) investigated the extent to which crime concentrates at places, and the stability of such concentration over time. They found that, for each year between 1989 and 2002, all crime incidents in the city occurred within 47%–53% of street segments. Remarkably, only 4%–5% of street segments in the city generated 50% of all crime incidents each year. This study represents another important turning point in research on crime at places. The approach employed in this study (Weisburd et al., 2004) has since been replicated in other cities with strikingly similar findings. For instance, using data for a period of 16 years, Curman et al. (2015) found that the patterns of crime concentration at places in the city of Vancouver, Canada, were very similar to those observed in Seattle.

In a further study, Weisburd (2015) studied the extent and stability over time of crime concentration at street segments across eight cities (seven within the US and one in Israel). The type of data and measurement of crime used in this study were the same across all the cities considered, and the findings consistent with the predictions of the law of crime concentration at places. Irrespective of the size of the cities (some cities were small while others were large) or the period studied, crime was found to be highly concentrated in particular places. For example, it was reported in this study that around 1.4% of street segments accounted for 25% of all crime incidents in New York (a city with a population of 8.3 million people), and in Tel Aviv–Yafo (a city with a population of 414,600 people), while around 5.5% of street segments accounted for 50% of all crime in these cities. Similar patterns were observed across all cities studied.

In a recent study in the city of Vancouver, Andresen et al. (2016) investigated the patterns observed for eight different crime types over a 16 year period. For all offence types considered, crime was found to be highly concentrated at street segments and intersections – although there was clear variation in degree of concentration across different crime types. For instance, only 7.11% (or 1.02%) of street segments accounted for all (or 50%) of robbery, while 31.27% (or 5.37%) of street segments and intersections accounted for all (or 50%) of burglary

during the same year. This means that, regardless of crime type, crime was found to be highly concentrated at the micro level of place. In another study concerned with (only) robbery in the city of Boston, Braga et al. (2011) found that only 12% (or about 8%) of street segments and intersections accounted for all (or 50%) incidents. The data for this study covered a period of 29 years, perhaps the longest period ever studied in the crime at places literature.

Other empirical studies conducted outside the US and Canada also provide support for the law of crime concentration at places. For instance, Weisburd and Amram (2014) found that, during a one year period, only 4.5% and 1% of the street segments in the city of Tel Aviv–Jaffa accounted for 50% and 25% of all the crime incidents recorded by the police. Using data for the period 2005–2009, Bowers (2011) found that, among facilities (i.e. entertainment and commercial facilities such as cafes, bars etc.) within the city centre of a large metropolitan area in the United Kingdom, 20% of places accounted for around 80% of all incidents. Additionally, just 0.22% (11 facilities) of places accounted for 11% of all incidents.

A recent study conducted in India (Mazeika and Kumar, 2016), a developing country with somewhat different ecological and physical settings from the studies so far discussed, also found crime to be

concentrated at places. For instance, four hotspots representing less than 1% of the total land in the study area accounted for about 23% of burglary incidents. This is the only study that I am aware of that was conducted in a setting similar to that of sub-Saharan Africa. Additionally, the crime data used in this study (Mazeika and Kumar, 2016) were geocoded using similar methods to those used in this thesis, only that in this study, police incident record data rather than that from a victimisation survey were used.

It is important to note that the intention here is not to present a systematic review concerning research on concentration of crime at places. Instead, it is to show that the patterns of crime concentration at places are consistent across studies – see Telep and Weisburd (2017) for a systematic review on this subject. To this point, it is clear that much evidence exists to suggest that a relatively small number of places in urban areas account for a disproportionate amount of crime. It is important, however, to also note that the crime at place studies – with the exception of Sherman et al., (1989), Johnson and Bowers (2010), and Davies and Johnson (2015) – are mostly descriptive in the sense that they do not show whether the clustering of crime at places observed exceeded expectations.

While the overwhelming evidence from the prior studies regarding patterns of crime concentration at places remain valid, it is still untenable to draw conclusions regarding the universal application of the law of crime concentration at place. Little is known of the patterns of crime concentration at places in developing countries particularly sub-Saharan Africa. Perhaps the challenges faced by researchers in these regions, particularly with regards to the availability of reliable and appropriate data, as discussed earlier in Chapter 3, are partly responsible for such a trend (see Arthur and Marenin, 1995; Alemika, 2004; Sidebottom, 2013). Nonetheless, more empirical testing in understudied settings is needed to ascertain the universality of the law of crime concentration at place.

4.2 Units of analyses in spatial criminology

The geographic units of analyses used in the early studies concerned with the spatial distribution of crime were mainly large areal units such as regions, departments, provinces, states or cities, perhaps due to the availability (or rather lack) of appropriate data at the time. As pointed out as far back as 1856 by John Glyde, the use of large areal units for analysis can hide the underlying variations in the distribution of crime across space (Steenbeck and Weisburd, 2015).

Over the years, there has been a growing trend of a move towards smaller units of analysis (Andresen, 2014), for instance, moving from regions to cities, counties to wards, neighbourhoods to street segments.

Although research concerned with the distribution of crime across space has for a long time recognized the importance of analysing crime trends at smaller spatial units, it was not until recently (see Andresen and Malleson, 2011; Steenbeck and Weisburd, 2015; Rosser et al., 2016), that there has been empirical testing of the degree to which urban crime varies across different geographical scales (for example, street segments and areal units). This recent work addresses important issues concerning what is the most appropriate spatial scale for analysis. For example, as mentioned in Steenbeck and Weisburd (2015):

“If crime is highly concentrated within a small number of streets, but these streets in turn are concentrated within a small number of neighbourhoods, then this favours neighbourhood-level explanations of crime rather than explanations at smaller units.”

(p.451)

The findings that have so far emerged regarding what unit of place is most appropriate for explaining patterns of urban crime (including

street segments and larger areal units) tend to favour the use of street segments. For instance, using an area-based spatial point pattern test that identifies similarities between two spatial point patterns, Andresen and Malleson (2011) tested the stability in crime pattern in Vancouver over a 10 year time span at three different spatial scales – census tracts, dissemination areas, and street segments. Although concentration of crime at places was observed at all spatial scales, the patterns observed at larger spatial units (i.e. census tracts and dissemination areas) were dictated by the clustering at street segments.

More recently, Steenbeck and Weisburd (2015) studied over 400,000 police crime records spanning a nine year period in the city of The Hague. They compared how much crime can be attributed to street segments, neighbourhoods, and districts spatial units. They found crime to be more concentrated at the street segment level than at neighbourhoods or districts. For example, reporting on the percentage of spatial units accounting for 50% of crime in the city, they found that during the year 2009, 50% of all crime incidents occurred on only 6.83% of street segments compared to 20.18% of neighbourhoods and 20.45% districts. Additionally, while all districts (100%) and almost all neighbourhoods (99.12%) had experienced at least one crime incident over the same period, only 52.28% of street segments did. Moreover,

the degree to which crime clusters, and the variability of such concentration across the spatial units, has remained stable over time. Using a Linear Mixed model approach to test for the variability of crime across different spatial units, the authors attributed much of the variability in crime to the street segments, concluding that micro-level units are important to understanding the pattern of crime across urban space.

The findings in the city of The Hague, as reported above, were remarkably similar to what Andresen and Malleson (2011) found in the city of Vancouver. Furthermore, not only that research has shown street segments would account for higher variations in the distribution of crime across space, it is also an appropriate geographic scale for predicting where future crime is likely to occur. Recently, Rosser et al. (2016) demonstrate that a street network-based model is a better and more accurate method for predicting where future property crime is most likely to occur – at a coverage of 5% for example, a street network-based model have identified 20% more crimes than a grid-based alternative (which was based on larger areal unit).

One benefit of understanding and predicting patterns of crime at the micro level of place, such as the street segment, is that police resources are limited and cannot be deployed everywhere and hence it helps in

allocating resources systematically – i.e. focusing on hotspot locations, a term used in describing chronic areas. As Braga et al. (2014) revealed in a systematic review of available evidence, the deployment of limited crime prevention and control resources to hotspot locations could reduce the overall rate of crime without any significant form of displacement. When analysis focuses on larger geographic units such as urban districts or neighbourhoods, the chances are an entire area would be identified as a crime hotspot when in reality, as highlighted above, only a few streets or a cluster of homes may account for a larger proportion of all crime incidents.

It is worth noting that the areal units often used in analyses that include meso-level of place in crime and place literature are administrative boundaries (for example see: Andresen and Malleson, 2011; Steenbeek and Weisburd, 2015). While this is convenient, these boundaries are usually created to serve some purposes other than scientific research. This will perhaps undermine the analysis of areal units that are characterized by maximum within-area homogeneity, an attribute that should be considered in regionalizing space (Rengert and Lockwood, 2009). Perhaps, using homogeneous areal-units could reduce a common interpretation error in crime analysis that arises when conclusion about individuals is drawn based on data about a group, a problem termed as “ecological fallacy” (Robinson, 1950).

In summary, urban crime is found to cluster in space, and of the spatial units considered for analysis in prior studies, micro units of analysis (e.g. street segments) are found to explain much of the concentration of crime within the city. In this chapter, the following hypotheses are tested to investigate whether such patterns are applied in the context of Nigeria:

Hypothesis 1: Crime will cluster at the household level more than would be expected on a chance basis given the distribution of homes.

Hypothesis 2: Crime will concentrate at each spatial unit of aggregation (i.e. street segments and neighbourhood), and the clustering will be more than chance expectation.

Hypothesis 3: Concentration of crime at the meso-level (i.e. neighbourhoods) will be driven by the pattern at the micro-level of place (i.e. street segments).

4.3 Data and Spatial Aggregation

Three spatial units of analysis are considered in this chapter – a) households b) street segments, and c) neighbourhoods. As described in Chapter 3, the URN generated during the field mapping exercise was

used to geocode the data collected in the crime victimisation surveys. The process generated a dataset with the XY-coordinates for each of the sampled properties. To recapitulate briefly, the key points, data were collected for 2,932 properties. In addition to the URN, each property was also assigned two other reference codes, one indicating the street segment, the other the neighbourhood in which a property is located. The data were aggregated to each unit of analysis to form the data that were used in the analysis of crime at the street segment and neighbourhood level. The location of each data point (sampled household) within the study site is shown in Figure 4.1.

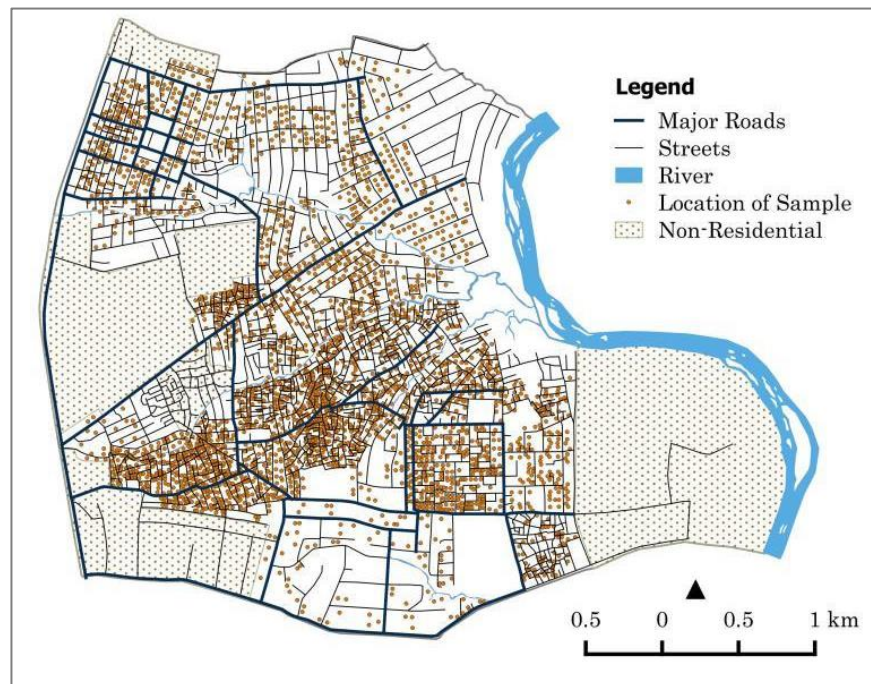


Figure 4.1: Location of sampled households

Street Segments

Following Weisburd et al. (2012), a street segment is defined here as the two faces of a city block between intersections. As a consequence of the urban form of the study setting (see Chapter 3), it should be noted that some street segments have as little as one household on them. There were 1,117 street segments in the study area. Of those, only 751 had residential properties located on them. The remaining street segments either hosted only non-residential properties (including vacant land or properties under construction), or just served to connect two streets (with no homes located on them). In the analyses that follow, patterns were explored only for those street segments that had homes on them. These street segments are shown in Figure 4.2.

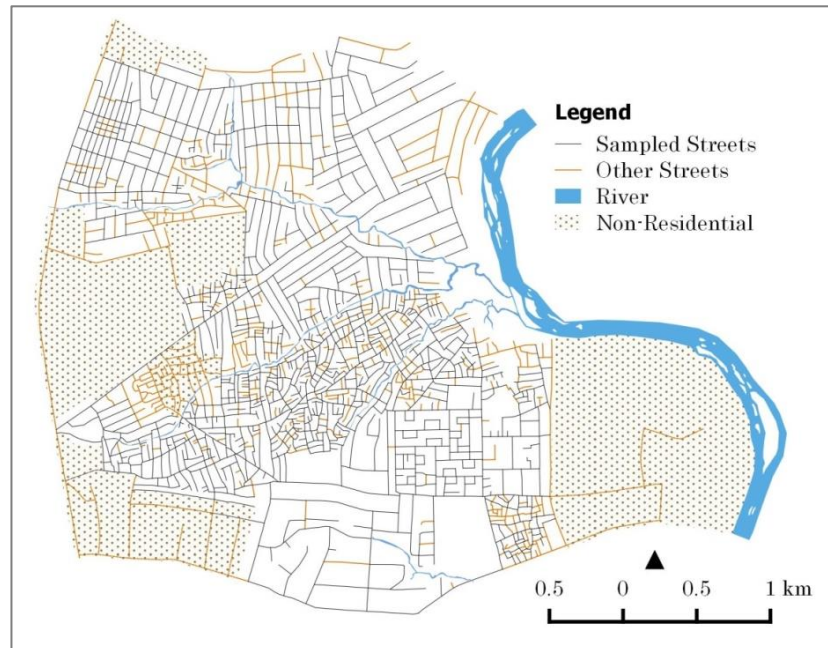


Figure 4.2: Street segments with (and without) homes

Neighbourhoods

As discussed in the previous section, prior studies concerned with areal units often relied on administrative boundaries (for example see: Andresen and Malleson, 2011; Steenbeek and Weisburd, 2015). In Nigeria, the lowest areal unit for which data on official (administrative) boundaries are available is the local government level for which the average population is over 230,000. Such areas are simply too large for studies concerned with environmental criminology, such as the one reported here. With no any existing (appropriate) area boundaries to rely on, in this thesis, one is purposely constructed to address this challenge.

A variety of approaches could be taken to do this, but the one adopted here takes the following form. First, the boundaries were defined with the intention of simultaneously minimizing the internal variance within neighbourhoods and emphasizing the difference between them. Needless to say, however, that a potential challenge with any such exercise is what has become known in the literature as the Modifiable Areal Unit Problem (MAUP) – that changing a boundary set can lead to different conclusions (see: Openshaw and Taylor 1979; Fotheringham and Wong 1991). Nevertheless, the approach taken had the following area demarcation rules:

Stage I: Demarcation based on the type of residential area – with areas classified as high, medium and low density based on the number of properties per unit of geographical area.

Stage II: Following natural boundaries such as streams and rivers that would naturally divide a neighbourhood.

Stage III: Considering physical manmade features, specifically major roads, that would also physically divide a neighbourhood.

This process was repeated until each neighbourhood so defined contained a population of between 4,000 and 6,000 people. Figure 4.3 shows the neighbourhoods identified using the above approach. A total of 40 areas were delineated – thirty-six met the definition set for a residential neighbourhood but only thirty-five were included in the present study (a survey in one neighbourhood was abandoned for reasons of safety because a local chief expressed strong disapproval of the exercise in the area – see Chapter 3).

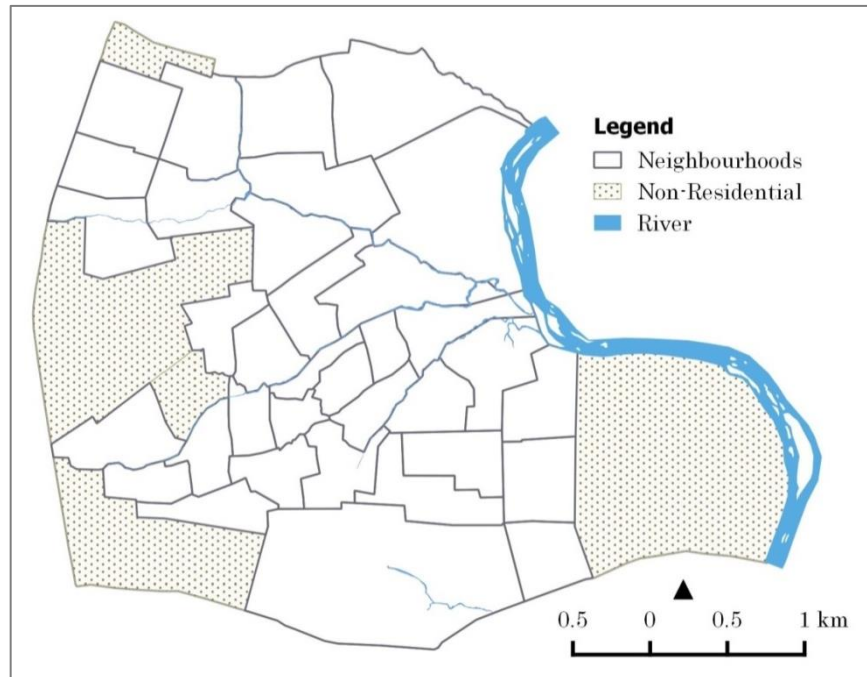


Figure 4.3: Neighbourhood boundaries

It is important to note that there is no consistency throughout the literature on the standard definition of a neighbourhood in terms of both the population size and geographical extent. The spatial units constructed here, however, are closely based on Harvey Zoubargh’s concept of a “natural area” – “a geographical area characterized both by a physical individuality and by the cultural characteristics of the people who live in it” (Zorbaugh [1926] in Lin and Mele, 2005: p.85). The areal units (neighbourhoods) derived using the approach described above, compared to administrative units used elsewhere (proxies of neighbourhoods), provides a more accurate representation of neighbourhoods.

Demarcation of neighbourhoods based on the type of residential area (housing density), for instance, ensures the grouping together of residents and dwelling types of similar characteristics. Hence, the neighbourhood units derived are characterised by maximum within-area homogeneity, an attribute that should be considered in regionalizing space (see: Rengert and Lockwood, 2009). Additionally, following both the natural and manmade features such as streams, rivers and major roads have allowed the demarcation of neighbourhoods with clear physical boundaries.

With such areal units, it provides not only an opportunity to test the variability in the distribution of crime across different units of analysis, but also to explore whether the degree to which crime concentrates at neighbourhood level, when compared to street segments, can lead to a different conclusion from those made in the previous studies regarding the appropriate spatial scale of analysis. Perhaps it might not (Wooldredge, 2002), although other research (for example: Ouimet, 2000) has shown that changing a boundary type could lead to a different conclusion.

4.4 Results

Concentration of crime at household level

First, descriptive statistics are presented prior to testing hypothesis regarding whether crime is spatially clustered more than would be expected on a chance base given the distribution of available targets. Considering the distribution of B&E and domestic theft together, 38% of households accounted for all reported crime incidents (3,350 incidents). The top 2% of the most victimised homes reported suffering an average of 13 incidents over the survey period, with 30 being the highest while almost a third (31%) of the victimised households only experienced just one crime during the same period. Half of all crimes observed (50%) occurred at only 8.5% of the households.

An even greater concentration of crime at place was observed when the two types of crimes were analysed separately. All domestic theft incidents occurred at 33% of households while only 8% of households produced 50% of all crimes. On the average, the top 1% of places accounted for about 13 incidents each – this is more than 1 incident per calendar month. The analysis further reveals that the crime concentration is higher for B&E than domestic theft. All the B&E incidents occurred at 15.6% of households with one-half of all incidents (50%) occurring at only 3.8% of households. The top 1% of the

most risky homes accounted for 20% of all incidents. Even on chance basis, you expect some variability across homes. For instance, the top 15 chronic places (0.5% of places) experienced an average of about 8 B&E incidents which translates to an average of at least two incidents every three months. Tables 4.1 and 4.2 show the observed distributions for B&E and domestic theft.

Table 4.1: Observed frequency distribution of breaking & entering

Frequency of incident	Respondents			Observed Incidents		
	(N)	(%)	Cum %	(N)	(%)	Cum %
0	2,475	84.41	-	-	-	-
1	253	8.63	8.63	253	29.11	29.11
2	109	3.72	12.35	218	25.09	54.20
3	49	1.67	14.02	147	16.92	71.12
4	21	0.72	14.74	84	9.67	80.79
5	6	0.20	14.94	30	3.45	84.24
6	9	0.31	15.25	54	6.21	90.45
7	5	0.17	15.42	35	4.03	94.48
8	1	0.03	15.45	8	0.92	95.40
9	0	0.00	15.45	0	0.00	95.40
10 \geq	4	0.14	15.59	40	4.60	100
Total	2,932	100		869	100	

Table 4.2: Observed frequency distribution of domestic theft

Frequency of incident	Respondents			Observed Incidents		
	(N)	(%)	Cum %	(N)	(%)	Cum %
0	1969	67.16	-	-	-	-
1	348	11.87	11.87	348	14.00	14.00
2	250	8.53	20.4	500	20.11	34.11
3	177	6.04	26.44	531	21.36	55.47
4	100	3.41	29.85	400	16.09	71.56
5	34	1.16	31.01	170	6.84	78.40
6	17	0.58	31.59	102	4.10	82.50
7	12	0.41	32.00	84	3.38	85.88
8	2	0.07	32.07	16	0.64	86.52
9	1	0.03	32.10	9	0.36	86.88
10	8	0.27	32.37	80	3.22	90.10
11	1	0.03	32.40	11	0.44	90.54
12	1	0.03	32.43	12	0.48	91.02
15	3	0.10	32.53	45	1.81	92.83
18	1	0.03	32.56	18	0.72	93.55
20 ≥	8	0.27	32.83	160	6.44	100
Total	2,932	100		2,486	100	

From the descriptive analysis above it is evident that crime concentrates at relatively small number of places, as has been previously observed in Euro–American cities (for example Sherman et al., 1989). It can also be determined whether this pattern is purely random or was generated by something other than chance. One approach is to compute the expected frequency distribution assuming a simple Poisson process (for example see: Sherman et al., 1989; Sagovsky and Johnson, 2007; Sidebottom, 2012). The Poisson distribution assumes that the probability of a household being

victimised is the same for all places, and that the probability does not depend on the number of previous events (Nelson, 1980).

The observed and the expected frequency distribution for both B&E and domestic theft, calculated assuming a simple Poisson process, are presented in Table 4.3 along with the observed frequencies.

Table 4.3: Observed and expected distribution of crimes by households (assuming a Poisson distribution)

No. of Crime	B&E		Domestic Theft	
	Observed	Expected	Observed	Expected
0	2,475	2,172	1,970	1,253
1	253	652	348	1,065
2	109	98	250	453
3	49	10	177	128
4	21	1	100	27
5	6	0	34	5
6	9	0	17	1
7	5	0	12	0
8	1	0	2	0
9	0	0	1	0
10	4	0	8	0
11	0	0	1	0
12	0	0	1	0
15	0	0	1	0
18	0	0	1	0
20 \geq	0	0	9	0
Total	2,932	2,933	2,932	2,932

The data suggest that fewer households are victimised than would be expected but those that are, are victimised more often than would be expected, assuming a Poisson process. That is, the risk of victimisation

appears to be more concentrated than would be expected. This is true for both B&E and domestic theft incidents. A Chi-square test confirmed that the difference between the observed and expected distribution was statistically significant (breaking & entering: $X^2 = 440$, $df = 10$, P-value = 0.0001, $n = 2932$ and domestic theft: $X^2 = 1368$, $df = 20$, P-value = 0.0001, $n = 2932$). Therefore, evidence exists to reject the null hypothesis that mere chance generated the distribution of crime in the study area.

The analysis presented above demonstrates that the concentration of crime at the household level can be explained by a simple Poisson process. What is unclear is whether victimised places, considering the distribution of opportunities (households), are spatially clustered in some particular areas. As research consistently demonstrates that crime concentrates spatially (see Section 4.1), it is often assumed that certain places will experience higher rates of crime than others. It is important, however, to note that the occurrence of clustering, when the distribution of opportunities is considered, could be insignificant (i.e. a pattern generated by mere chance). A general approach to objectively confirm whether crime clusters in space, considering the distribution of opportunities, is to conduct a statistical test. Such a test is particularly useful in determining not only the degree to which

crime concentrates at particular places but also whether the clustering is statistically significant or simply a chance occurrence.

Nearest Neighbour Analysis

The aim here is to estimate whether or not crime is spatially clustered at the household level in Kaduna. To the best of my knowledge, such a hypothesis has never been tested using data for a city in sub-Saharan Africa. Although other approaches do exist, the one taken here employs the Nearest Neighbour test method to estimate whether crime (B&E and domestic theft) is spatially clustered more than would be expected on a chance base considering the distribution of homes.

The Nearest Neighbour test approach (Getis, 1964) is not complex, clustering is quantified by examining the observed mean nearest neighbour distance for a sample of data compared to the expected nearest neighbour mean distances assuming that the spatial distribution of events is completely random. For each crime event, the first-order nearest neighbour distance is determined by simply calculating the Euclidean distance between that event and the one closest to it. The second-order nearest neighbour distance is the distance between such each event and the next closet. Other orders, depending on the number of orders of interest, are determined in the

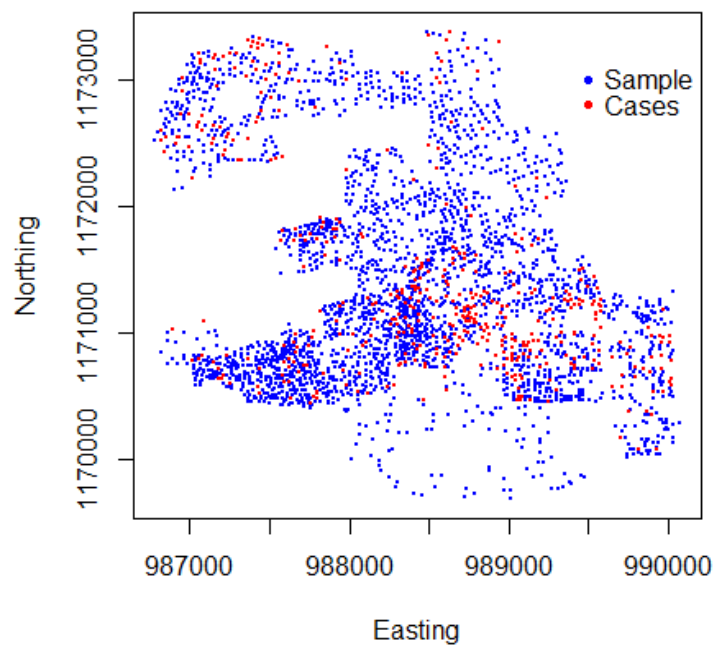
same way. The mean nearest neighbour distance for a particular order is then calculated by taking the average distance across all crimes.

Complete spatial randomness is usually assumed in the nearest neighbour test approach (Getis, 1964). However, the assumption that the spatial distribution of crime events could be completely random is unrealistic. That is, opportunities for crime are not evenly distributed across space. For instance, B&E or domestic theft crimes can only occur at residential households. For this reason, an alternative nearest neighbour test which uses a Monte Carlo method described in Johnson (2010) was used here. Not only does this method compute the nearest neighbour distances between points of interest it also takes into account the distribution of the actual opportunities in the derivation of the test statistics, and allows statistical significant test for orders other than the first nearest neighbour which the standard test doesn't. This approach has been used in other studies of spatial point patterns of crime (for example see Hopenstal and Johnson, 2010).

Additionally, it is important to note that prior studies do not use survey data for the kind of analysis presented here. The data commonly used is for a whole population. However, the data used here is a sample of households. This alone could generate spatial clustering, and so defining the distribution of homes surveyed is critical to avoid

producing misleading result. In this present study, the exact location of all households in the sample represents the distribution of the actual opportunities. Figure 4.4 is a plot of the dataset showing all sampled households (blue dots), and places where incidents have occurred (red dots). A plot of the observed and the mean expected nearest neighbour distances (for orders 1 – 10) for (a) B&E and (b) domestic theft is shown in Figure 4.5. The solid black line in the graph is the mean nearest neighbour distances of the observed distribution while the mean expected is shown in the dotted line and the confidence interval values generated using the Monte Carlo (MC), the 2.5th and 97.5th percentile, is shown in grey.

The Spatial Distribution of Breaking & Entering



The Spatial Distribution of Domestic Theft

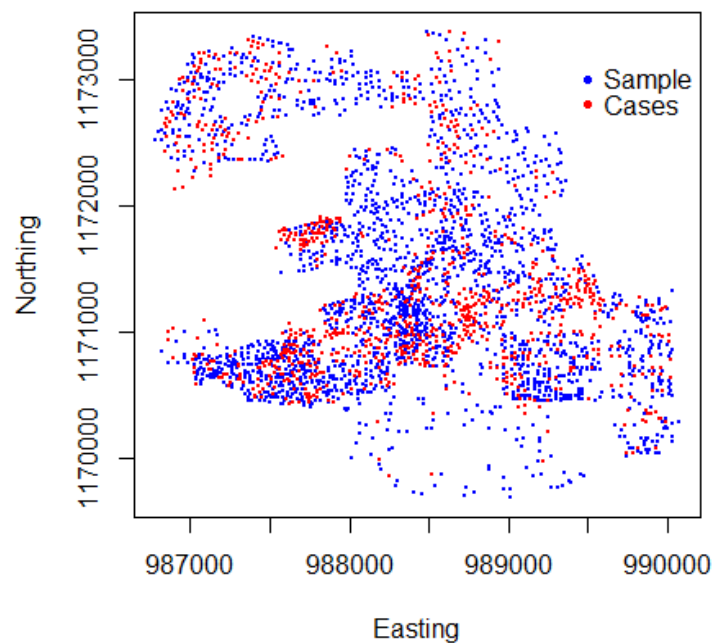
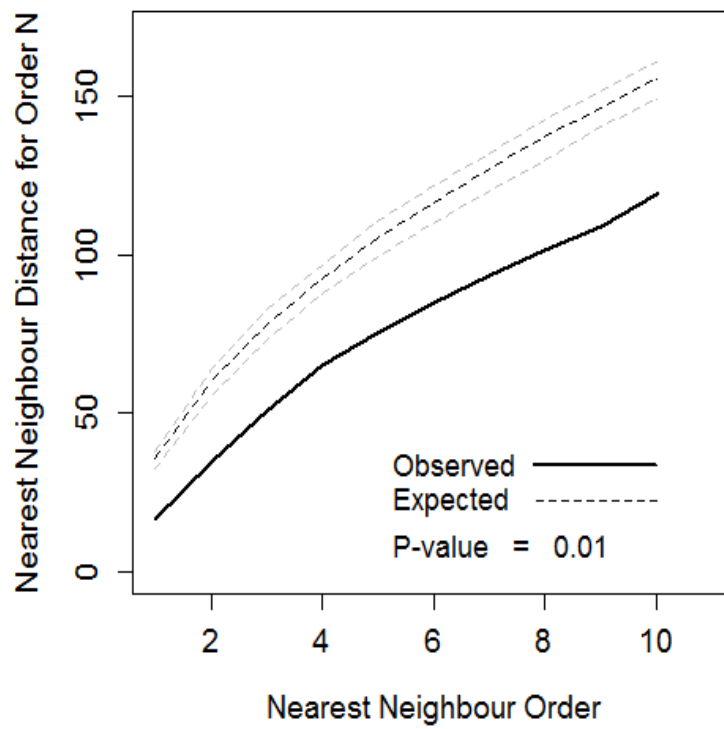
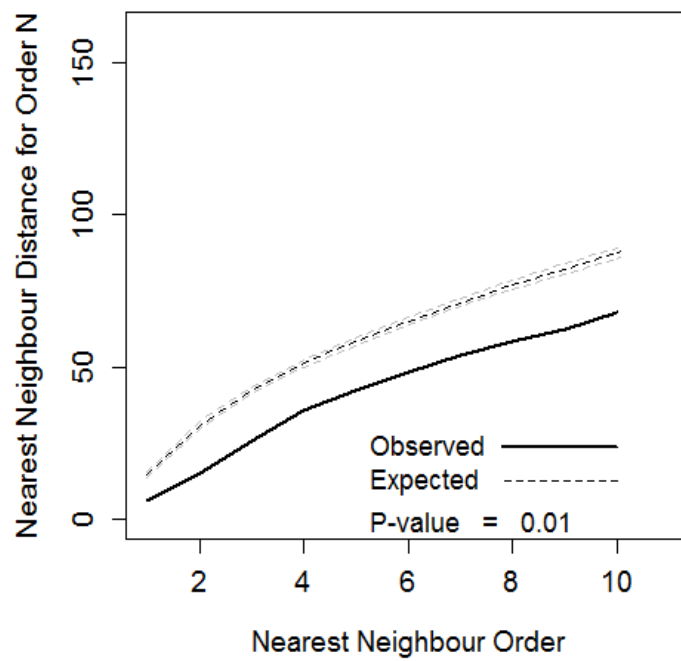


Figure 4.4: Spatial distribution of crime in Badarawa–Malali



a)



b)

Figure 4.5: Plot of the observed and the mean expected nearest neighbour distances (for orders 1 – 10)

The interpretation of the results is straightforward – where the observed mean nearest neighbour distance is less than that expected, it suggests that there is more spatial clustering than would be expected assuming the risk of crime was uniform across homes. Statistical significance is established if the values of the observed distribution are outside the confidence intervals for the expected distribution (North et al., 2012). The deviation in the observed and the expected can also be derived by dividing the value of the observed from that expected. This is the nearest neighbour index (NNI). Where the value of the NNI is equal to 1, this suggests that the mean nearest neighbour distance of the observed and that expected are the same, indicating that any spatial clustering observed in the data has occurred on a chance bases.

The observed mean nearest neighbour distances (for orders 1 – 10) were less than those expected for both B&E and domestic theft. In the case of the B&E, the observed mean nearest neighbour distance of 16.4 meters (m) was less than half that expected (35.9m). The NNI value of 0.47 suggests that B&E incidents clustered in space more than would be expected on a chance bases. The pattern for domestic theft was also found not to be random. The mean nearest neighbour distance of 5.7m was much less than that expected (14.6m). In this case, the NNI value of 0.39 suggests that events were spatially clustered more than would

be expected. All results for all nearest neighbour orders (1 – 10) were statistically significant at a p-value of 0.01.

Patterns of Crime Concentration at Aggregate Units

Given that there is clustering at the household level, does this mean that crime also clusters at other spatial scales, specifically at the street segment or neighbourhood levels? In this section, I examine patterns of crime concentration at places using the same data used in the previous section but here aggregated to (a) street segment and (b) neighbourhood level. First, the patterns of crime concentration at street segments and neighbourhoods are described followed by a test of the degree to which crime clusters at each spatial scale. Second, a test regarding whether the patterns observed at these spatial scales reflect anything beyond the ones observed at the household level. Finally, analyses are conducted to see whether patterns observed at the micro-geographic scale (here street segments) can account for the clustering at a meso-geographic scale (here neighbourhoods).

Concentration at the street segment level

All observed incidents considered (B&E and domestic theft combined – 3,355) occurred along only 65% of the street segments. Moreover, 50% of crime occurred on only 11.32% of the street segments. Additionally,

the top 2% of places, the most chronically victimised street segments, accounted for 520 (15%) incidents with the highest number of offences recorded at one street segment being 55 during the observation period of one year. On average, these chronically victimised segments experienced at least 3 incidents every calendar month.

When the two types of crimes were analysed separately, the pattern of concentration was even greater. About 39% of street segments did not experience any theft incident, with all crime of this type occurring on 61% of street segments. Additionally, about 10.92% of street segments accounted for 50% of all the theft incidents. Approximately, 17% of incidents were observed on around 2.3% of the street segments – these are the most chronically victimised places on which 20 or more incidents occurred. About 7% of the street segments experienced 11–20 incidents, 9.6% recorded 6–10 incidents while the other 20% and 21.8% have experienced 3–5 and 1–2 incidents respectively.

Similarly, the data show that crime is concentrated at the street segment level for the B&E crime. All incidents (and 50%) occurred on about 38% (7.58%) of street segments. Additionally, only 5.3% of the street segments have experienced more than 5 incidents – just 0.13% experienced 20 or more incidents, 1.3% recorded 11 – 19 and 3.9% exhibits 6 – 9 incidents. These places (about 5.3%) accounted for over

41% of all the B&E incidents. Of those street segments that have experienced B&E, about 60% have only recorded 1 – 2 incidents while another 26.4% exhibits 3 – 5 incidents.

Concentration at the neighbourhood level

Turning to the pattern of crime concentration at neighbourhoods, although there were not any “crime-free” neighbourhoods (both B&E and domestic theft have been reported in each of the neighbourhoods); the data confirm that crime clusters in particular places. Just four neighbourhoods (about 11%) accounted for 25% of all crimes (both B&E and domestic theft) – accounting for an average of 205 reported incidents each. About 50% of all crimes were reported to have occurred in around 28% of neighbourhoods. In the relatively low crime areas, about seven neighbourhoods (20%) accounted for less than 4% of all incidents. Two neighbourhoods recorded 15 or fewer crimes for the period considered. The pattern was even more revealing when the two crime types were analysed separately.

In the case of domestic theft, on the one hand, about 50% of all incidents were reported to have occurred in around 28% of the neighbourhoods. Five neighbourhoods (14%) accounted for 30% of all incidents reported with one neighbourhood alone accounting for 8% of all incidents. At the other end of the spectrum, five neighbourhoods

(14%) only accounted for around 2% of all reported incidents. B&E was a rarer crime, understandably concentrates at places more than the domestic theft incidents. About 50% of all B&E incidents were recorded in about 25% of neighbourhoods. Only four neighbourhoods (11%) have accounted for about 30% of all B&E crimes – one neighbourhood, the most chronic, accounted for about 9% of all the observed incidents. In the relatively low crime places, nine neighbourhoods (25%) recorded around 5% of all B&E incidents. Of these places, four neighbourhoods recorded less than 1% of all the incidents – each reported an average of three incidents in the period under review.

Summary of crime concentration

The descriptive analysis presented above shows that crime concentrates at all spatial levels of aggregation – although the degree to which this occurs differs between street segments and neighbourhoods. To summarise, following the approach taken by Andresen and Malleson (2011; see also Steenbeck and Weisburd, 2015), the percentage of spatial units that account for all (and 50%) of the crime incidents is presented in Table 4.4.

Table 4.4: Percentage of spatial units accounting for 50% of crime

Spatial Unit	(a) % that have any crime		(b) % accounting for 50% of all crime		(c) % with crime that account for 50% of crime	
	B&E	Theft	B&E	Theft	B&E	Theft
Street Segment	37.77	61.04	7.59	10.92	20	17.91
Neighbourhood	100	100	25.71	28.57	25.71	28.57

From Table 4.4, it can be seen that: (a) crime was not reported to have occurred on all street segments (B&E or domestic theft) – some are crime-free places. In contrast, crimes were reported for all neighbourhoods. (b) Compared to neighbourhoods, a relatively smaller percentage of street segments accounted for 50% of all the crime incidents for both the B&E and domestic theft. (c) Of those spatial units that have accounted for all crime incidents, the percentage of street segments that accounted for 50% of all crimes is also lower than that for neighbourhoods.

Testing the degree to which crime concentrates

The descriptive analysis presented above shows that, of the two spatial units considered, a greater degree of crime concentration was observed at the street segment level (micro-geographic unit) than at neighbourhoods (a meso-geographic unit). However, the analysis only

looked at the number of crimes recorded on each street segment or neighbourhood. It is important to note that these spatial units, whether street segments or neighbourhoods, do not have the same number of households – consequently, the opportunity for crime is not evenly distributed across the study area. Besides, the data used here is based on a sample not the whole population. To address this, Lorenz curve (Lorenz, 1905) is used to examine the degree to which crime clusters at each spatial scale, considering the actual distribution of crime opportunities across the study area. Although this method was originally proposed for measuring the concentration of wealth (Lorenz, 1905), whereby the cumulative percentage of income (ranked according to the size of each share) is plotted against the cumulative percentage of corresponding population, it has been applied in the study of crime concentration at places (for example see Johnson and Bowers, 2010; Davies and Johnson, 2015, Steenbeek and Weisburd, 2015).

Specifically, the analysis here adopted the approach used by Johnson and Bowers (2010) – since the distribution of households (crime opportunities) is unequal across street segments (and neighbourhoods), spatial units were ranked based on crime rates, from the highest to the lowest, computed as the total number of incidents divided by the number of sampled households per street segment (or neighbourhood). The Lorenz curve (Lorenz, 1905) is plotted as the

cumulative percentage of crime experienced across each spatial unit against the cumulative percentage of the sampled households. The plot is shown in Figure 4.6 – (a) for B&E and (b) for domestic theft – which illustrates the degree to which crime concentrates at the two spatial units. The black (dotted) line in the graph is the observed distribution of crime at the street segment (neighbourhood) level while the red solid line is the simple line of equality, computed by assuming that the distribution of crime incidents is perfectly equal across all street segments (or neighbourhoods)¹⁴.

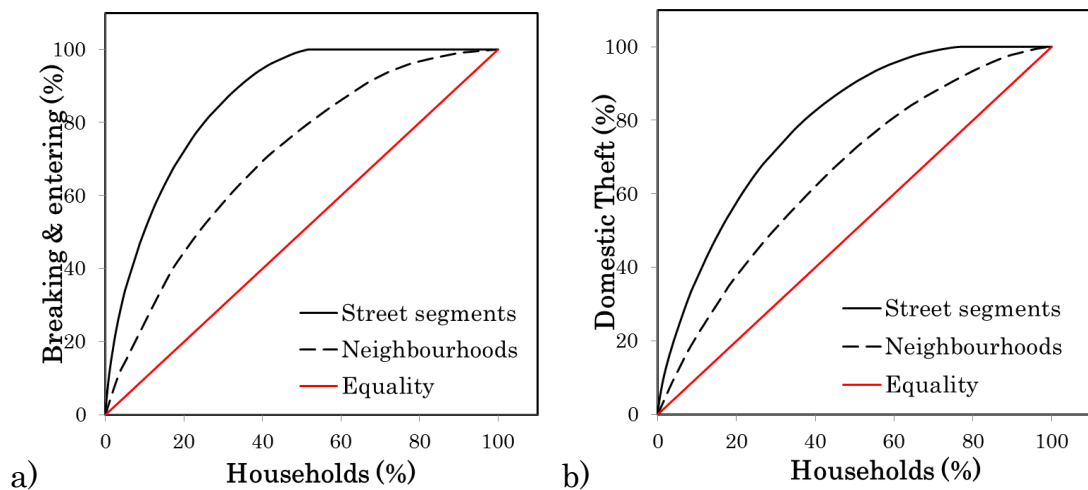


Figure 4.6: Lorenz curves for B&E and domestic theft (comparing two spatial units)

¹⁴ Note: Johnson and Bowers (2010) used an MC simulation to determine the line of equality (expected distribution), considering that the distribution of crime opportunities is unequal across homes. Such approach has been considered in the next section. The aim here is to illustrate and compare the degree to which crime concentrates at the street segments and neighbourhoods; it is not to demonstrate whether the clustering is more than would be expected.

As illustrated above (Figure 4.6), for both the B&E and domestic theft, the curve representing the street segments is further away from the simple line of equality than that for neighbourhoods, indicating more clustering at street segments. To summarise these patterns more directly, Gini index is computed for each spatial scale. This method was originally proposed for measuring inequality in the distribution of income (Gini, 1912), and is defined as the area between the observed curve and the line of equality in the Lorenz plot. The measure of Gini index ranges from 0 – 1, where a value of 0 indicates that the distribution of crime across spatial units is entirely equal, while a value of 1 indicates the distribution is completely unequal, suggesting that all crime incidents occurred in only one place. The values derived from the computation for both the B&E ($GI = 0.7858$) and that of domestic theft ($GI = 0.6825$) at the street segment level all approach 1, indicating an unequal distribution of crime across the study area. Considering the neighbourhood spatial units, the Gini index also indicates that both the B&E ($GI = 0.4143$) and domestic theft ($GI = 0.3576$) concentrate at places. These findings suggest that, as has been observed elsewhere (for example Andresen and Malleson, 2011; Steenbeck and Weisburd, 2015), crime is concentrated at all spatial units of analysis, although more so at the street segment level.

While Lorenz curve and Gini index are becoming popular methods in the crime at places literature to measure and summarize the patterns of crime concentration, it is important to note that, as Bernasco and Steenbeek (2016) demonstrated, these methods exaggerate the degree to which crime concentrates when the number of places considered in an analysis (i.e. unit of analyses such as street segments or neighbourhoods) is greater than the number of crime incidents. In this present study, the number of spatial units considered – the street segments ($N = 751$) on the one hand, and neighbourhoods ($N = 35$) on the other – are all less than the number of crimes included in the analysis – the B&E ($N = 869$) and domestic theft ($N = 2486$) incidents. Overestimation of crime concentration at places is therefore not a concern here. Moreover, in the analysis that follows, this problem is addressed more explicitly using a Monte Carlo (MC) simulation (see Johnson 2010).

Testing whether clustering is more than chance expectation

To this point, the analyses presented here demonstrate that crime clusters at all spatial scales (i.e. the street segments, and neighbourhoods). However, they do not indicate whether the degree of concentration exceeds chance expectation. Nor do they indicate if the crime concentration observed at the aggregate units reflects anything beyond the pattern observed at the household level. To address this,

using Lorenz curve and Gini index, I examine the extent to which both the observed B&E and the domestic theft are spatially concentrated (at street segments and neighbourhoods) in comparison to what would be expected – assuming that crime opportunity (homes) is unequally distributed across each spatial unit. The approach taken is similar to the one described in the previous section, only that here an MC simulation is used to determine the expected distribution (instead of the simple line of equality which assumes that the distribution of crime opportunity is equal).

To recapitulate, spatial units were ranked based on crime rates – Lorenz curve is plotted as the cumulative percentage of crime experienced across each spatial unit against the cumulative percentage of the sampled households (see Johnson and Bowers, 2010). To produce the expected distribution, following Johnson and Bowers (2010), an MC simulation approach was used in the following way: observed incidents were redistributed across the sample to produce a set of synthetic datasets which represents the expected distribution of incidents with the assumption that all homes have an equal chance of being victims. For each iteration of the redistribution procedure, a random number generator was used to select a virtual victim. The process maintained the same rate of re-victimisations as in the data for the observed incidents. This process was repeated 20 times from

which the mean expected values are derived. Additionally, these 20 iterations will allow the computation for statistical significance (of <0.05) between the observed and the expected distribution. Figure 4.7 shows Lorenz curves for street segments (panel a and b), and for neighbourhoods (panel c and d). The black dotted line in the graph is the observed distribution while the grey dotted line represents the mean expected (line of equality).

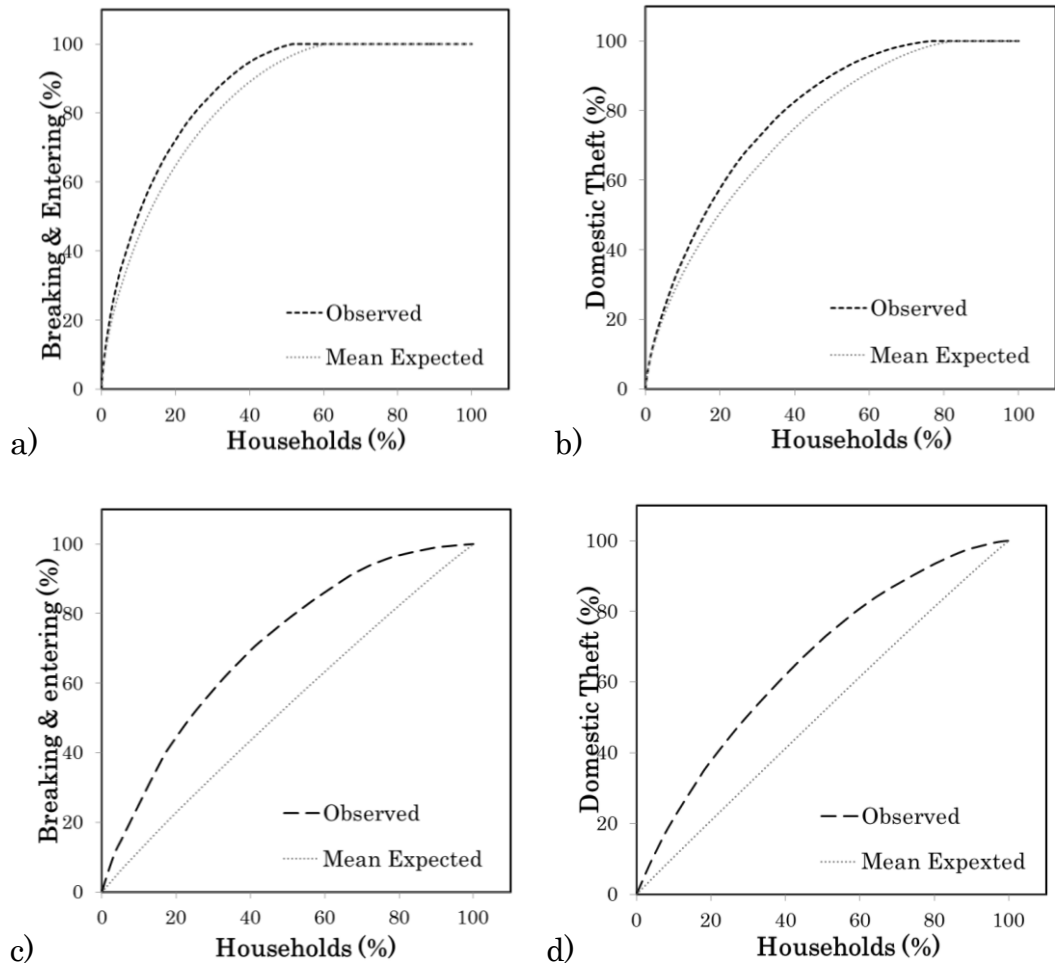


Figure 4.7: Lorenz curves for B&E and domestic theft (a – b: street segments, and c – d: neighbourhoods)

It is clear from the Lorenz plot that, for both crime types and at each spatial scale, the distribution of the observed incidents differs from that would be expected suggesting that the pattern is generated by some factors other than mere chance – i.e. there is a street (and neighbourhood) effect. Another way to verify this is to examine how the Gini index (GI) of the observed compares to that would be expected. The GI value derived for the observed – street segments (B&E = 0.7845, domestic theft = 0.6821) and neighbourhoods (B&E = 0.4143, domestic theft = 0.3576) – is higher than that for the mean expected – street segments (B&E = 0.7555, domestic theft = 0.6475) and neighbourhoods (B&E = 0.2944, domestic theft = 0.2344) – meaning that crime is spatially concentrated more than would be expected. Using the GI value for each of the expected distribution, the statistical significance p is computed as (see North et al., 2012):

$$p = \frac{n - r + 1}{n + 1}$$

where n is the number of the synthetic datasets and r is the position which 0 would take in a rank-ordered list of the difference between the values of the observed and the expected for the Gini index (see: Johnson and Bowers, 2010). In all the computations for the street

segments and neighbourhoods (in the case of both B&E and domestic theft), the value for the difference between the observed and that would be expected is above 0 meaning that the findings are statistically significant at $p = <0.05$.

Testing the importance of micro-level of place

The analyses from previous sections indicate that crime concentrates at all spatial aggregate units, and such clustering is more so at the street segments (micro-level) than at neighbourhoods (meso-level). This indicates that micro geographic units are central to understanding the spatial pattern of urban crime. However, given that there are more street segments ($N = 751$) than neighbourhoods ($N = 35$), perhaps clustering will naturally be higher for the former than the latter. One approach to verifying the importance of micro geographic scale is to examine whether the distribution of crime at the neighbourhood level is dictated by the pattern at the street segments.

To do this, Lorenz curve and Gini index are used to compare the clustering observed at the neighbourhood level to what would be expected, where the expected distribution is determined by simulating the patterns at the household (and street segment) level. Specifically, Lorenz curve is plotted as the cumulative percentage of crime experienced across neighbourhoods against the cumulative percentage

of the sampled household. An MC simulation approach (Johnson and Bowers, 2010), as described in the previous section, was used to produce two datasets for the expected distribution. One considers the distribution of crime opportunities as a function of the street segments within each neighbourhood (Expected 1) and the other as simply a function of the distribution of households (Expected 2). The simulation procedure for selecting virtual victims, for both the Expected 1 and 2 datasets, was repeated 20 times from which the mean expected values are derived. Figure 4.8 shows the Lorenz plot – a) B&E and b) domestic theft – where the black solid line in the graph is the observed distribution while the black (and grey) dotted line represents the mean expected, given the distribution of crime opportunities at the street segment (and household) level.

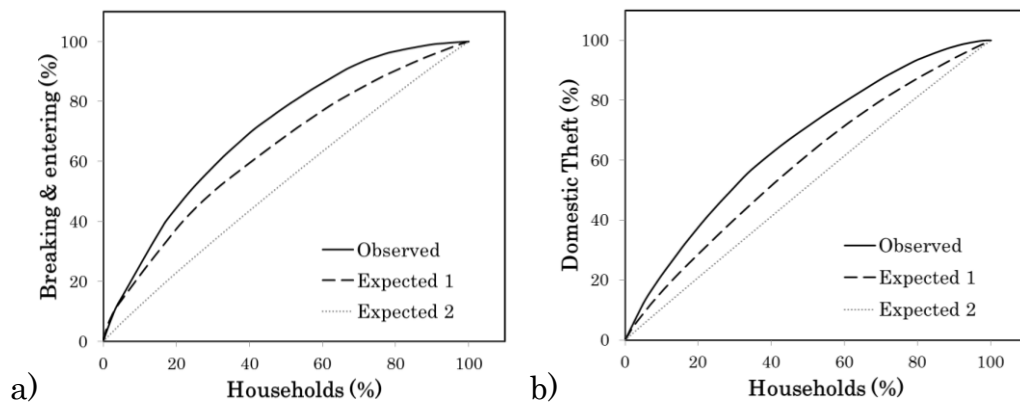


Figure 4.8: Lorenz plot of the observed and expected distribution of crime at neighbourhood level

From the Lorenz plot for both crime types (Figure 4.8), comparing the observed distribution of crime to what would be expected where the expected distribution is a function of the street segments within each neighbourhood (Expected 1); crime is relatively less concentrated compared to when the expected distribution is simply a function of the households within each neighbourhood (Expected 2). This indicates that the concentration of crime at the neighbourhood level is in part explained by the pattern at the street segment level, highlighting the importance of analysing crime pattern at the micro-level of place. All findings are statistically significant at $p = <0.05$.

4.5 Discussion

David Weisburd (see Weisburd, 2015) has raised an interesting question regarding the universality of the *law of crime concentration at places* – are there circumstances or contexts that this law does not apply? Perhaps for the first time in an ever growing literature on crime at places, this chapter provides an insight on the patterns of crime concentration at micro level of places in the context of sub-Saharan Africa – a setting that has not been considered in the past. The questions addressed here were: does crime clusters at places in settings of sub-Saharan Africa more than would be expected by

chance? And, if so, to what degree does crime concentrates at different spatial units of analysis? These are very basic questions in the crime at places literature, and of the studies that I am aware of, no such questions have been asked of Kaduna or any city in sub-Saharan Africa.

Throughout this chapter, I have discussed the findings of prior studies regarding patterns of crime concentration at places (e.g. Sherman et al., 1989; Weisburd et al., 2004), the appropriate spatial units of analysis (e.g. Andresen and Malleson, 2011; Steenbeck and Weisburd, 2015), and what this means for crime control and prevention (e.g. Braga et al., 2014). Here, I compare these prior findings with those observed in Kaduna using crime data from a micro-level victimisation survey, as opposed to the police recorded crime records that are typically used in the studies conducted in Euro-American settings. The implications of such findings with regards to theory and practice are then discussed.

Considering the findings regarding patterns of crime concentration at places first, it was apparent that not only does crime concentrates at all spatial levels (household, street segment, and neighbourhood) in the settings of Kaduna, the patterns observed are consistent with those found elsewhere (e.g. Sherman et al., 1989; Weisburd, 2015;

Andresen and Malleson, 2011; Mazeika and Kumar, 2016). For instance, around 11% (and 3.31%) of all addresses in the city of Minneapolis accounted for all (and 50%) of burglary incidents within a one year period (see: Sherman et al., 1989), similarly 15% (and 3.8%) of sampled households accounted for the same proportions of B&E incidents (the same types of crime) in the case of Kaduna.

When the data were aggregated and analysed at street segment and neighbourhood levels, the patterns were also consistent with what has been found elsewhere (e.g. Weisburd et al., 2004; Andresen and Malleson, 2011; Weisburd 2015; Curman et al., 2015; Weisburd and Amram, 2014; Steenbeck and Weisburd, 2015;). The consistency in patterns of crime concentration at places in distinct contexts provides further supports for the universal application of the law of crime concentration at places. This means that regardless of context – whether a well-planned or an unplanned setting – whether emergency call records/police incident report or crime data from a victimisation survey – urban crime will concentrate at only few places.

Regarding the appropriate unit of analysis in crime at places, the findings in this chapter suggest that, as demonstrated elsewhere (e.g. Andresen and Malleson, 2011; Steenbeck and Weisburd, 2015), the degree to which crime concentrates at the micro-level of place (here at

the street segment level) is greater than that at larger areal units (here at the neighbourhood level), bearing in mind that the areal units considered in the analysis here were purposely constructed to ensure maximum between-area (and minimum within-area) variations to reduce the concern regarding ecological fallacy.

Considering patterns observed elsewhere, in the city of The Hague for instance, 50% of all crimes occurred on 7.28% of street segment and in 20.18% of neighbourhoods. Additionally, while around 52% of street segments experienced at least one crime, almost all (99.12%) did in the case of neighbourhood units. This is not dissimilar to what was found here – around 11% (and 65%) of street segments accounted for 50% (and all) crime incidents (here only B&E and domestic theft were considered) while around 29% (and 100%) of street segments accounted for 50% (and all) crime incidents in the neighbourhood units of analysis.

Additionally, to a greater extent, the analysis in this chapter demonstrated that the concentration of crime at the neighbourhood level is in part a function of the distribution of crime at the street segment level, supporting the findings reported elsewhere (e.g. Andresen and Malleson, 2011; Steenbeck and Weisburd, 2015). It means that few street segments might be driving the concentration of

crime at the neighbourhoods. Perhaps this suggests that smaller units of analysis such as the street segments contribute greater than the larger units in explaining the variations in the distribution of crime across space, again, regardless of the context or settings. Another possible explanation is that the areal units that were used here are also not immune, or at least have not reduced, the interpretation error that arises from the ecological fallacy. This is highly unlikely, as highlighted in this chapter; the rules employed in the construction of the neighbourhood spatial units were carefully outlined.

Turning to the limitations of this present study, the data used here do not permit testing of the stability of crime across space over a period of time. It is important to note that this does not invalidate the findings presented here and that many other studies do not do this (e.g. Weisburd and Amram, 2014; Mazeika and Kumar, 2016). However, to place such findings in the broader crime at places literature, future research should consider the use of datasets that span a longer period of time – perhaps ten years would be ideal. The use of police recorded data is one option if such data become available (for example see: Mazeika and Kumar, 2016), although caution must be taken when using such data in Nigeria (see: Chapter 3). Additionally, data from the police could allow the analysis of all crime types. The analysis here

is limited to two property based crimes. Thus, it is possible that different patterns would be observed for other types of crime.

Finally, the findings presented here have implications for crime prevention and control. They suggest that hotspot policing, at least in theory (see Braga et al., 2014), could work in reducing the overall rate of crime in settings such as Kaduna. However, a deeper understanding of the processes that lead to crime clustering spatially is necessary to better understand how to prevent it. As highlighted in Chapter 2, there are a variety of explanations as to why crime concentrates at few places. In the environmental criminology literature, two theoretical perspectives – the social disorganization and opportunity perspectives – are dominant. Although developed in settings of Euro–American cities, in the next 2 chapters, these perspectives are considered, as I do here with law of crime concentration at places, to test whether they apply in the context of a setting in sub–Saharan Africa.

Chapter 5

Testing Theories of Social Disorganization in Nigeria

In the previous chapter, concentration of crime – breaking & entering (B&E) and domestic theft – was shown to vary across different spatial units such as households, street segments, and areas. This supports the premise underlying the law of crime concentration at places (see: Weisburd, 2015). Moreover, such variations, as demonstrated in that chapter, are generated by factors other than mere chance. In the environmental criminology literature, as discussed in Chapter 2, the variation in rates of crime could be explained using either of two theoretical frameworks – the framework of the social disorganization theory or the opportunity

theories. The former is considered in this chapter while the latter in the chapter that follows (Chapter 6).

Social disorganization theory was originally developed to explain the variation in the rates of crime across neighbourhoods in the city of Chicago and has been considered in prior studies conducted in Euro–American cities. Here, the approach is applied in the context of a developing country – Nigeria. Differences between Nigeria and Euro–America are considered in terms of the likely utility of such theory and how it might be tested in the developing world. This chapter is structured as follows: the next section is a recap on the premise of social disorganization theory and the lack of research in the developing world. The section that follows provides a review of the different components of social disorganization theory, the mechanisms through which they are believed to operate, how they have been estimated in previous studies, and whether they are meaningful in the context of Nigeria. The next section provides a brief description of the data and the geographical units of analysis used in this chapter. The next section presents an empirical test of social disorganization theory using data for Nigeria. The final section discusses the challenges associated with conducting such research in developing countries, the findings, and their implications for criminological understanding.

5.1 Theories of Social Disorganization

As discussed in Chapter 2, social disorganization theory evolved from the influential work of Clifford Shaw and Henry McKay in the city of Chicago – ‘*Juvenile Delinquency and Urban Areas*’ (see: Shaw and McKay, [1942] 1969). They argued that community social organization, seen as the ability of residents of a neighbourhood to control and supervise teenage peer groups, is influenced by three structural factors – low socio-economic status (SES), ethnic heterogeneity, and residential mobility – which, in turn, lead to higher rates of crime. While the framework of this theory has guided much research, it is important, however, to note that existing research is predominantly based on the experiences of US cities (for example, Warner and Pierce, 1993; Kawachi et al., 1999; Sun et al., 2004) and other parts of the developed world (for example, Sampson and Groves, 1989; Veysey and Messner, 1999; Lowenkamp et al., 2003; Mazerolle et al., 2010; Bruinsma et al., 2013).

The scarcity of research concerning the developing world is due in part to the challenges associated with the availability of appropriate and reliable data. The few studies that exist have been focused on violent crime (e.g. Breetzke, 2010; Pereira et al., 2016), whilst the support for theories of social disorganization (in these studies) is

only partial. This means that little is known of the applicability of theories of social disorganization in developing world contexts, particularly sub-Saharan Africa.

In Western Europe and North America, criminological theories are typically tested using data either recorded by the police, or from large-scale survey samples used to collect nationally representative data. As discussed in more detail in Chapter 3, in most developing countries, particularly sub-Saharan Africa, police recorded crime data are either unavailable or lack the detail necessary for statistical analysis. National representative surveys are sometimes conducted, and while there are clear advantages to this approach to sampling, what such surveys lack is detailed data at the micro level of place. Such detail is necessary for testing of theories of environmental criminology, particularly those for which characteristics of the built environment are considered important. As new and innovative methodologies for collecting data emerge (for example: mobile data capture devices), as well as, the improvement in access to police recorded data for research purpose in the developing world (for example see: Mazeika and Kumar, 2016), the empirical testing of such theories will become more practicable in other parts of the world. For now, much of such testing must rely on

established methods of primary data collection, as discussed in Chapter 3.

Components of Social Disorganization Theory

The exogenous sources of community social (dis)organization were initially conceived to be socio-economic status (SES), ethnic heterogeneity, and residential mobility (see: Shaw and McKay, [1942] 1969). These were later extended to five to include urbanization and family disruption (see: Sampson and Groves, 1989). As discussed elsewhere (for example: Bruinsma et al., 2013; Chapter 2), these components of social disorganization have been measured differently across different studies. It is important to consider the mechanism(s) through which they are assumed to impact upon crime, how they have been estimated, and whether they are meaningful in the context of Nigeria. To allow focusing on conceptual issues, in this section, a detailed description of the data used here is avoided, leaving that discussion until Section 5.2.

Socio-economic Status (SES)

The association between SES, measured at the area level, and rates of crime is a dominant theme in ecological studies of urban crime. SES is one of the most important components of Shaw and McKay's

(1969) social disorganization theory. As discussed in Chapter 2, in the original version of the theory, it was hypothesized that in 1940s Chicago residents of lower SES would have few housing options available to them – as such, they would tend to live in the less popular transitional zone of the city, but would aim to move out as soon as they had the resources to do so. This created transitory neighbourhoods in which residents had little investment or the resources to change their surroundings – thus, the willingness of people to participate in local organizations would be weaker. This would impact on the ability of people to exert informal social control over the behaviour of juveniles. These communities (the theory suggested) were accordingly characterized by high crime rates.

More recent research conducted in other cities has emphasized the latter structural characteristic of low SES neighbourhoods as a causal factor in neighbourhood rates of crime, and this hypothesis has been empirically tested using different variables as an estimate of neighbourhood SES. The average household income of those who live in an area has been the foremost indicator of SES – in some cases used as a single scale (see for example, Cahill and Mulligan, 2007; Markowitz et al., 2001), and in others as part of a composite measure that includes other dimensions of social class, such as educational attainment and employment level (see for example,

Sampson and Groves, 1989; Veysey and Messner, 1999; Lowenkamp et al., 2003). In other studies (for example: Pereira et al., 2016), these dimensions of social class were considered as standalone variables (not composite) for measuring SES. The data used in these studies were either obtained from national population censuses or household/crime surveys. In another study of social disorganization theory, Bruinsma et al. (2013) used data from a national census and a community survey to construct an index of SES that included the average household income variable together with unemployment rates, the average value of residential properties, and the percentage of residents receiving social benefits in a neighbourhood.

In the context of most of the developing world, collecting data on such variables, particularly average household income is difficult and rarely approached directly. Issues such as reporting-bias or non-response to questions relating to earnings or wealth have been a serious concern (Lindelov and Yazbeck, 2004). Consequently, studies of SES have tended to use proxy measures, particularly those relating to housing characteristics and the possession of durable assets (Howe et al., 2008). This alternative approach reduces the problem of reporting-bias and non-response that is associated with conventional measures of income or wealth (Sahn and Stifel, 2003) – data are typically collected using simple

questions or less biased observational methods such as the block environmental inventory (Perkins et al., 1992), poverty scorecard (Schreiner, 2010), or asset indices (Filmer and Pritchett, 2001). This approach is adopted in the current study.

Hypothesis 1: there will be a negative association between estimates of neighbourhood SES and crime rates.

Ethnic Heterogeneity

From a social disorganization perspective, relative to those who live in homogeneous neighbourhoods, residents of heterogeneous communities are considered less likely to be able to communicate effectively with one another, or to share common goals and normative values about what types of behaviour are and are not appropriate. In turn, such communities are expected to be less cohesive, and to be less likely to act collectively to control crime (Sampson and Groves, 1989; Kubrin, 2000). Prior studies have measured heterogeneity as the proportion of the minority race in the population, black race for instance (see: Blau and Golden, 1986; Messner and Golden, 1992). However, as this fails to reflect the variety of racial groups in a neighbourhood, other researchers have used (for example) the index of diversity (Simpson, 1949) to calculate the heterogeneity of a neighbourhood.

However measured, the principle underlying the approach is that people from the same (different) ethnicity or race are likely to share similar (different) cultural beliefs and normative values. In many cities around the world, such an approach may make sense. However, in cities such as Kaduna, where almost all the population is of one race, it is less likely to provide a useful metric of neighbourhood cohesion along these lines. An alternative interpretation of ethnicity in this context is captured by what some may refer to as “tribes”. As stated earlier in Chapter 3, Nigeria is a multi-ethnic/cultural society – with over 300 different tribes (Otitie, 1990; Rakov, 1992). Some share common values, and some form of trust, mutual assistance, and harmonious relations exist between some of these tribes (Otitie, 1990). Moreover, it is common to see inter-tribal marriages. However, it is also important to note that each tribe has their own unique language and culture. In the context of social disorganization theory (Shaw and McKay, 1969), where a lack of effective communication between residents of a neighbourhood is hypothesized to affect social cohesion, here, it is argued that, in Nigeria, the notion of tribes better captures the spirit of the idea of “heterogeneity”.

Hypothesis 2 there will be a positive association between the ethnic heterogeneity (measured in terms of the diversity of tribes) of a neighbourhood and rates of crime.

Residential Mobility/Stability:

Residential stability and mobility are expected to have opposing effects on crime rates. On the one hand, residential mobility was hypothesized by Shaw and McKay (1969) to disrupt the social network of a community, which in turn may lead to higher rates of crime. On the other hand, Sampson and Groves (1989) suggest that residential stability has the opposite effect by allowing social ties to form in a community, which has an attendant effect on residents' investment in a community and their ability to "police" it.

While the two concepts (residential stability and mobility) are essentially reciprocal, the way they are measured means that they are not entirely interchangeable. Both are straightforward to calculate, and residential mobility is perhaps the most consistently computed variable employed in the social disorganization literature – typically measured as the percentage/ratio of new-to-total residents in a neighbourhood. Those who have lived in an area for a period of less than one year are usually considered new residents (see for example: Sampson and Groves, 1989). In the case of

residential stability, the numerator is the number of long-term residents – assumed to be those who have lived in an area for at least five years (Bruinsma et al., 2013) or those who were brought up in the neighbourhood (Sampson and Groves, 1989).

These measures are typically calculated using data collected for government censuses. As discussed in Chapter 3, such exercises are conducted between five to ten years in the developed world, and easily accessible for research purposes. This is not the case in Nigeria; data from population censuses are often out of date and lack the spatial granularity required for environmental criminology research such as the one reported here (the smallest areal unit being local government areas, which have an average population of 230,000). This poses problems for estimating population stability at the local level, and, consequently, population estimates were collected locally as part of the survey described in Chapter 3.

Hypothesis 3: there will be a positive association between the rate of residential mobility in a neighbourhood and crime rates.

Hypothesis 4: there will be a negative association between the rate of long-term residential stability in a neighbourhood and crime rates.

Urbanization

In their extended model of social disorganization theory, Sampson and Groves (1989) included urbanization as an exogenous community characteristic that they hypothesized would influence area-level crime rates. The premise was that urban communities, when compared to suburban or rural areas, *“have a decreased capacity for social control”* (p.782). The assumption is that the crowded nature of urban neighbourhoods limits close personal interactions between residents. And, as such, this way of life is characterized by the depersonalization of relationships and a lack of identity that tends to weaken the ability of residents of a neighbourhood to form and maintain local friendship networks, which consequently affects their level of participation in local affairs (Hardyns and Pauwels, 2009). In previous studies, the location of neighbourhoods in relation to the centre of the city – areas that are usually characterized by high population density, mixed land use and intense activities (commonly referred to as inner-city neighbourhoods) – has been used to measure urbanization (see for example: Veysey and Messner, 1999; Lowenkamp et al., 2003). Other studies have used population density derived from government population censuses (Cahill and Mulligan, 2007), housing density or a combination of the two (Bruinsma et al., 2013). These estimates of urbanization are not complex, or unattainable in

a setting of a developing country such as Nigeria. Identifying the inner-city neighbourhoods – intense activity areas with different land uses – is fairly straightforward. In this chapter, it is argued that urbanized neighbourhoods – those characterized by mixed land use and high intense activities – are those areas that host business clusters (places such as markets or shopping areas).

Hypothesis 5: there will be a positive association between urbanized neighbourhood and crime rates.

Family disruption

Another component of social disorganization measured in some studies (see: Sampson, 1987; Sampson and Groves, 1989; Veysey and Messner, 1999; Lowenkamp et al., 2003; Sun et al., 2004; Bruinsma et al., 2013) is family disruption. Sampson (1987) argued that informal social control is stronger in communities with less marital and family disruption, because such communities will have a greater capacity to supervise peer-groups and delinquent youths. In the extended model of social disorganization theory (Sampson and Groves, 1989), the level of family disruption in a neighbourhood was measured using two variables – single parent households (with children), and the ratio of divorced/separated adults to those who have ever married (see also: Veysey and Messner, 1999; Lowenkamp

et al., 2003). Other studies have measured this component using only the percentage of divorced/separated (Sun et al., 2004) or the percentage of single parent households in a neighbourhood (Bruinsma et al., 2013). Again, in the developed world, information regarding the proportion of divorce/separated adults in a community could be derived from census data or marriage register. Although such registers do exist in developing countries such as Nigeria, rarely do people (formally) record marriages or divorce/separation.

While the components discussed, thus far, largely have some meaning in the context of a developing country such as Nigeria, family disruption – or estimates of it at least – are likely to be of limited utility. For instance, single parenting is not a common practice in Nigeria. In a recent study, Essien and Bassey (2012) revealed that single mothers faced enormous challenges in the Nigerian society including discrimination and outright rejection from the community. The social norm dictates, for example, that a divorced woman is expected to move back to her parent's home while a man is considered incapable of raising a child on his own. Also, premarital/out-of-wedlock childbearing is not common in many traditional societies such as Nigeria, and is in fact considered a taboo. Thus, single-parent households are likely uncommon in Nigeria and it is unclear as to whether family homes that include

single parents differ meaningfully in their ability to exert social control over those in their neighbourhood. Consequently, despite the popularity of this measure in western studies, there was no attempt to measure this indicator of social disorganization in this chapter.

Units of Analysis in Social Disorganization Theory

The concept of Shaw & McKay's social disorganization is fundamentally "*a group-level analog of control theory*" (Bursik 1988: p.521). However, in prior studies of social disorganization theory, the geographic definition of a group or, rather, a community, appears to be somewhat vague – there is no consistency throughout the literature on the standard areal unit of analysis. Even though the selection of any unit of analysis should be informed by theory, more often than not, researchers adopt area level boundaries such as census blocks and tracts in the US (for example, Sun et al., 2004), or electoral wards and polling districts in England and Wales (for example, Sampson and Grove, 1989; Veysey and Messner, 1999; Lowenkamp et al., 2003) for which data are readily available. In a recent study, Hart and Waller (2013) suggested that:

“Administrative proxies of neighborhoods are inconsistent with perceived neighborhood boundaries and that perceived neighborhood structural

determinants of social disorganization are also inconsistent with official measures”.

(p.16)

The research reported in this chapter (or rather in this thesis) is faced with a different challenge – not of dealing with inappropriate administrative boundaries, but that of not having any official small area units that could be used to represent a neighbourhood. With no existing (appropriate) area boundaries to rely on, as indicated in Chapter 4, spatial units are purposely constructed to address this challenge. The construction (demarcation of neighbourhood boundaries) adopted some rules to ensure maximum within-area homogeneity, an attribute that should be considered in regionalizing space (see: Rengert and Lockwood, 2009). In a way, this provides an opportunity to study the theories of social disorganization in this chapter using spatial units that are closely based on Harvey Zoubargh’s concept of “natural area” (instead of administrative units) – *“a geographical area characterized both by a physical individuality and by the cultural characteristics of the people who live in it”* (Zorbaugh [1926] in Lin and Mele, 2005: p.85). As pointed out in Chapter 4, of the forty neighbourhoods identified in the study area, only thirty-five are included in the analyses presented in this thesis.

5.2 Measurement of Variables

This section will describe the variables used to test expectations derived from social disorganization theory. The data used in the analysis that follows were derived from both the BEI exercise and the household and crime victimisation survey reported in Chapter 3. As will be discussed in more detail below, the data from the BEI exercise were used to derive the SES and urbanization variables – information on housing characteristics were used to construct the index of socio-economic status while data regarding the location of land use for each property were used to identify urbanized neighbourhoods. The data from the household and crime victimisation survey were used to derive the remaining independent variables (ethnic heterogeneity, residential mobility, and residential stability) and the two dependent variables (B&E and domestic theft). All data points were aggregated to neighbourhood area level.

Dependent variables

The crime rates per 100 households sampled were computed for breaking and entering (B&E), which is defined as an incident that involves breaking into a property with the intention to steal (B&E, n

= 869), and domestic theft, which is defined as an offence of stealing from a property without breaking in (n = 2,486).

Independent variables

1. *Socio-economic Status (SES)*: an index of neighbourhood SES was constructed using three measures relating to housing characteristics (see below). The index of SES was derived by taking a composite (z) score of these three variables as described below:

a) Building Construction Material: as reported in Chapter 3, not all buildings are constructed using cement – the standard building construction material in Nigeria – some are constructed using mud (see: Table 3.6 in Chapter 3). The concentration of mud houses in a neighbourhood is an indicator of a lack of resources as the use of this material in construction is a matter of means rather than choice. Data for this variable were collected as part of the BEI exercise, and this variable was computed as the percentage of properties within a neighbourhood that were constructed using cement.

b) Type of housing: drive-in residential houses are usually more expensive to construct and to rent. They have facilities such as a private parking area that other houses lack. It is assumed here that

the more affluent population will reside in such properties. The distribution of drive-in houses in the study area is presented in Table 3.7 (see Chapter 3). This index was computed as the percentage of properties in a neighbourhood with a gate.

c) Road condition: as is the case in many developing countries, not all roads in urban area are paved. Neighbourhoods with good roads that have been paved will typically host the most valuable residential houses. The condition of each street segment was confirmed using Google Earth plug-in during the data digitization process. This variable is measured as the percentage of properties in a neighbourhood that could be accessed via a paved road.

For each dimension (a–c), a z-score was computed for each neighbourhood. The mean z-score computed across the three indices was then used as a composite index of SES for each area.

2. Ethnic heterogeneity: a total of 65 different ethnic groups (or tribes, see Chapter 3) were identified from the data collected as part of the household survey (see: Table 3.8 in Chapter 3). However, for 50 such groups, these were represented by only 1 – 5 members in the whole sample. Based on the connectivity that exists between these ethnic groups (see above), it is only logical to reduce the number of

groups used to produce a smaller set that would reflect the ideas that underpin social disorganization theory. To do this, the 65 ethnicities were categorized into five broader groups based on their region of origin and the socio-cultural relationship that exists between them. The five categories were:

a) Northern Majority – comprising Hausa–Fulani, the largest indigenous ethnic group in the city and the Kanuri, a major tribe in the Northeast of Nigeria.

b) Northern Minority – these are mainly minority ethnic groups of Northern Nigerian extraction.

c) Middle Belt – these are the ethnic groups who originated from the Middle Belt region of Nigeria.

d) Eastern – these include the Igbo ethnic group and the Niger Delta indigenes.

e) Western – the Yoruba ethnic group that originated from the Western region of Nigeria.

To measure neighbourhood ethnic heterogeneity, the Simpson's Diversity Index (Simpson, 1949) was used. This takes account of the number of groups and their relative sizes in the population, it is expressed as:

$$D = 1 - \left(\frac{\sum n(n-1)}{N(N-1)} \right)$$

Where: $N = \text{Total sample size across groups}$

$n = \text{Sample size for a particular group}$

The level of diversity D is represented by a value between 0 and 1, where 0 indicates a perfectly homogeneous neighbourhood (with only one ethnic group) while 1 indicates a perfectly heterogeneous neighbourhood.

3. Residential Mobility: as part of the household survey described in Chapter 3, respondents were asked – for how long have you lived at this address? The response options were – Less than 1 year; Between 1 – 2 years, 3 – 5 years, and More than 5 years. The residential mobility variable was measured as the percentage of households in the sample who have lived in a neighbourhood for a period of less than one year.

4. Residential Stability: this variable was measured using the same data as for residential mobility. However, here, the percentage of households in the sample that have lived at their address for a period of five years or more was taken.

5. Urbanization: this variable is measured using a binary indicator. Neighbourhoods with a business cluster such as a market or shopping area with twenty-five or more retail shops are identified as urbanized neighbourhoods. The urbanized neighbourhoods are assigned a value of 1 while the others are assigned 0.

5.3 Results

Table 5.1 provides descriptive statistics for the dependent and independent variables. There is considerable variation in the rates of crime between neighbourhoods – from a low of 2 and 9 to a high of 107 and 204 incidents per 100 households for B&E and theft, respectively. As already demonstrated and discussed in Chapter 4, crime was clustered at the neighbourhood level. Moreover, the pattern is generated by factors other than mere chance. Here, it is clear that there was variation in the structural measures of social disorganization between neighbourhoods – for instance, residential

stability ranges from less than 17% to more than 89% while residential mobility ranges from 0% to more than 20%. Would this mean that the theoretical framework of social disorganization could explain the patterns of crime concentration at neighbourhood level in the present study area? Below are models for each crime type that tested this hypothesis.

Table 5.1: Descriptive statistics for the dependent and independent variables – related to neighbourhoods

Variable	Minimum	Maximum	Mean	Std. Dev.
Dependent Variables				
B&E per 100 HHOLDS	2.28	106.46	31.67	25.16
Theft per 100 HHOLDS	8.93	204.13	86.01	50.24
Independent Variables				
SES	-1.28	1.42	0.00	0.62
Heterogeneity	0.10	0.63	0.34	0.13
Res. Mobility	0.00	20.51	5.60	4.43
Res. Stability	16.67	89.47	69.48	16.78
Urbanization	0.00	1.00	0.57	0.50

To test hypotheses, ordinary least square (OLS) regression models were used for each crime type. However, because one of the core assumptions of OLS regression – that observations are independent – may be violated for data that have an explicitly spatial structure,

the Moran's I test statistics was also computed (using a distance band contiguity weight) to assess whether this assumption was met. Where the assumption that observations are independent was not met, an appropriate spatial regression model was used, selecting from either a spatial lag or spatial error models, based on the values of the Lagrange Multiplier (see: Anselin, 2005).

A further potential problem with regression models concerns multi-collinearity – when two or more of the predictor variables in a regression model are correlated. To test for this, the variance inflation factor (VIF) was computed for each variable to estimate the extent to which multi-collinearity was likely to be a problem. A VIF score of 10 or more is commonly regarded as an indication of severe multi-collinearity (Neter et al., 1996; O'Brien, 2007), although the standard cutoff value can be as low as 4 (Fox, 1991), while a value of less than 2 indicates highly independent variables (Judge et al., 1985). As can be seen in Table 5.2, none of the independent variables exceed either VIF threshold, indicating no serious problems with multi-collinearity. The result of the OLS model is presented in Table 5.2. All the estimates, both the OLS and the spatial regression models, were computed using GeoDa 1.8.

Table 5.2: The Ordinary Least Squares (OLS) regression model for domestic theft

Variables	<i>B</i>	<i>t</i>	<i>Sig.</i>	VIF
SES	-36.949	-2.757	0.01	1.350
Heterogeneity	17.429	0.267	0.791	1.255
Res. Mobility	0.139	0.055	0.883	2.480
Res. Stability	-0.105	-0.149	0.883	2.528
Urbanization	32.253	1.876	0.071	1.429
<i>N</i> = 35 / <i>Adj. R</i> ² = 0.29 / <i>F</i> -statistics = 3.795				

Domestic Theft

In the case of domestic theft, all coefficients were in the expected direction. However, only the coefficient for the SES variable was statistically significant ($p = 0.01$) – neighbourhoods with lower estimated SES tended to experience higher rates of theft than their counterparts. The Moran’s I test for this dependent variable was non-significant ($p = 0.42$) suggesting no significant problem with spatial autocorrelation for this model, and no need for further analysis using a spatial regression model.

Breaking and Entering

For breaking and entering, a Moran's I test indicated positive spatial autocorrelation ($p < 0.002$) and, hence, it was necessary to analyse the data using a model that accounted for this. Based on diagnostic tests and advice provided in Anselin (2005), the data were analysed using a spatial error model. The spatial error regression model is estimated by means of maximum likelihood, and unlike the traditional classic regression models, it includes a spatial autoregressive error term (Anselin, 1988). Formally, the regression model is expressed as:

$$y = X\beta + \lambda W\varepsilon + u$$

Where y – is the dependent variable

X – is a matrix of independent variables

β – are associated parameters for the independent variables

λ – is a parameter that measures spatial interaction

W – is a spatial weights matrix

ε – is vector of spatially autocorrelated error terms

u – is an independent and identically distributed error term

The spatial weights matrix included in the spatial error regression model was based on a distance band – where a neighbour is defined based on the distance between the centroid of neighbourhoods (see: Anselin, 2005). The results of the analysis are shown in Table 5.3.

Table 5.3: Spatial (Error) Regression model for breaking & entering

Variable	Coefficient	<i>z</i> -value	Significance
SES	-2.0123	-0.3288	0.7423
Heterogeneity	25.3718	0.9392	0.3475
Res. Mobility	3.2029	3.4091	0.0007
Res. Stability	0.6307	2.1224	0.0338
Urbanization	6.2004	0.8499	0.3953
LAMDA (spatial error term)	0.5288	3.3301	0.0009

With the exception of residential stability, the direction of all coefficients was consistent with expectation. However, only two of the coefficients were statistically significant, and one of these (residential stability) was in the wrong direction. Thus, for B&E the analysis provides only a partial support for expectations derived from social disorganization theory.

5.3 Discussion

Both the social and physical settings of cities in the developing world (sub-Saharan Africa in particular) differ greatly in comparison to those in the developed world. This chapter has highlighted these contextual differences and considered how social disorganization theory, a theory developed to explain area level crime rates in the developed countries (particularly the US), might explain the distribution of crime in a developing country such as Nigeria. Other issues also discussed throughout this chapter are concerned with some challenges associated with testing hypotheses derived from such theories in the Nigerian context. The next thing is to reflect on these issues, discuss how such were addressed and how future studies might do so, and consider how the findings inform the criminological enterprise.

Considering the challenges first, regarding the availability of appropriate data for the dependent variable, this issue has been exhaustively discussed in Chapter 3. Here, emphasis will be on the challenges regarding the estimation of the independent variables. But to emphasise the point, with respect to the dependent variable, official police records or large scale sample surveys which are commonly used to estimate area-level rates of crime in studies

conducted in the developed world were not available for the research reported in this thesis. Instead, the data from a micro-level victimisation survey were used. Future research might use similar methods, perhaps taking advantage of the opportunities that new and innovative technologies provide (e.g. mobile data capture devices).

Considering the independent variables, various indicators of social disorganization have been used in previous studies. The discussion in this chapter regarding some of the most commonly used measures highlighted the fact that some are simply not appropriate in the context of Nigeria, or are too difficult to measure. For instance, SES, commonly estimated using data regarding average household income, is a sensitive issue that is difficult to measure in developing countries. For this reason, in this current study, proxy measures relating to housing characteristics were used, which are more easily collected (see: Chapter 3) and arguably more appropriate in studies of crime in developing countries. Future studies might consider other indicators that are sensitive to local context.

The measurement of neighbourhood heterogeneity and indicators of family disruption also require consideration and sensitivity to the context and culture within which the research is conducted. For

example, in Nigeria the population consists almost entirely of one race of people, making traditional estimates of ethnic heterogeneity of little value. An alternative measure of diversity, using tribal origin as the source of variation, was consequently used to better capture this component of neighbourhood composition.

Finally, an issue that is often acknowledged but rarely (if ever) addressed in studies of neighbourhood crime rates concerns the boundaries used. Studies conducted in the UK and elsewhere generally employ boundaries derived to facilitate the collection of data for population censuses or administrative purposes. While effort may be expended to define areas that maximize within-area homogeneity and between-area heterogeneity, such boundaries are not created for the purposes of studying crime, and do not necessarily represent what residents would consider ‘neighbourhoods’ (see: Hart and Waller, 2013). In the current study, the problem is different – in the absence of existing administrative boundaries, which approach should be taken to define the areas used for analysis? To address this issue, the approach taken in this thesis (see: Chapter 3) involved the systematic application of logical rules to delineate neighbourhoods, a process also employed elsewhere (e.g. Sampson et al., 1997). Future work might also explore the use of participatory mapping exercises (for example see: Hart and Waller,

2013), whereby residents are consulted in an iterative fashion to ascertain their perceptions of neighbourhood boundaries.

Having discussed key conceptual and practical differences between studies conducted in developed and developing countries, it is now time to turn to the question of what the findings presented in this chapter tell us about the role that mechanisms of social disorganization might play in explaining area level crime rates in Nigeria. In the case of domestic theft, although all of the predictor variables were in the expected direction, the only coefficient that was statistically significant was the index of SES. For the crime of B&E, only two variables, residential mobility and residential stability were reliable predictors of area level rates of crime. However, while the finding for annual rates of residential mobility was in line with expectation (there was more crime in neighbourhoods with high population turnover), that for residential stability was contrary to expectation – areas with more stable communities in the long-term had more crime.

The findings, therefore, provide only limited support for social disorganization theory. For each model, of the five variables included, reliable associations were only observed for one variable. Perhaps this is not surprising because a number of studies in the US

and elsewhere have provided only partial support for theories of social disorganization (for example: Sun et al., 2004; Breetzke 2010; Bruinsma et al. 2013; Pereira et al., 2016). What does this mean for such theory? One explanation is that the theoretical framework, originally developed to explain rates of crime in 1940s Chicago, does not apply universally. Perhaps other local area conditions, other than (or in addition to) those originally conceived, would better explain the processes of social (dis)organization in other communities, and, thus, account for the between–area variations in the rates of crime. Understanding these local area conditions, therefore, is essential for contextualizing criminology theories such as that of social disorganization.

Other explanations are that the estimates of the various components of social organization considered here failed to capture the constructs they sought to estimate, or that the sample size – which is admittedly modest – was insufficient to detect the kinds of associations reported in other studies (e.g. Sampson and Groves 1989). Which is the more likely explanation will be for future research to resolve, but for now what this study highlights is that caution should be exercised in studies that seek to explain rates of crime in one context using theories developed for another. It is hoped that future research will be informed by the issues discussed here,

and encourage researchers to further test and develop theories of environmental criminology in new contexts.

Chapter 6

Opportunity theories and the risk of victimisation

It has been demonstrated in Chapter 4 that the distribution of crime (breaking & entering and domestic theft) in Kaduna varies across space, and at different spatial scales (i.e. households, street segments, and neighbourhoods). Crime clusters at particular places but not in others, a pattern that is consistent with findings from elsewhere (e.g. Sherman et al., 1989; Weisburd et al., 2004; Andresen and Malleson, 2011; Steenbeck and Weisburd, 2015). The aim of this chapter is to explore whether particular characteristics of places are associated with an elevated risk of victimisation.

The theoretical framework of social disorganization was considered in Chapter 5 to explore between-area variation in the risk of victimisation across urban neighbourhoods of Kaduna. In that chapter, the theoretical approach taken focused on how social processes within communities (neighbourhoods) might influence the risk of victimisation (Shaw and McKay, 1969; Sampson and Groves, 1989). The results from Chapter 5 were mixed, providing only partial support for theories of social disorganization in Kaduna. In this chapter, the interest turns to the examination of variation in the risk of victimisation across individual households, using the theoretical framework of opportunity theories. As such, the perspective taken focuses on the physical environment and how particular situations might create the opportunity for crime (see: Meier and Miethe 1993).

The perspective of opportunity theories have guided substantial research in the last 30 years, some of which have focused on property-based crimes including burglary. Prior studies that have employed this perspective – much of which have been conducted in Euro-American cities – have typically sought to understand whether specific characteristics of a potential target such as level of guardianship influence the risk of victimisation (e.g. Miethe and Meire, 1990; Tseloni et al., 2004; Tseloni, 2006). I am aware of no

study that asked such question of Kaduna or Nigeria, and neither am I aware of any study across sub-Saharan Africa that has been subjected to the intensive data collection exercise described in this thesis (see: Chapter 3). Consequently, it is unclear whether opportunity theories of crime have any utility for explaining the risk of victimisation in a country like Nigeria.

Using data from the BEI and the crime victimisation survey described in Chapter 3, the risk of victimisation for two crime types, breaking & entering (B&E) and domestic theft, are analysed here using a binary logistic regression (BLR) modelling approach. Where possible, the variables used in estimating these models are similar to those considered in prior studies conducted in Euro-American settings. The chapter is organized as follows: for context, the next section begins with a recap of opportunity theories of crime. This is followed by a description of each situational aspect that influences the crime opportunity structure, the mechanism through which they are assumed to influence the risk of victimisation, and how they have been estimated in prior studies. The section that follows describes how each of the variables considered were measured here and which component of the opportunity structure for crime they were intended to estimate. The result of the BLR models are

presented in the section that follows. The final section discusses the findings and what they mean for future research.

6.1 Components of Opportunity Theories

As detailed in Chapter 2, opportunity theories include: the routine active theory, crime pattern theory, and the rational choice perspective. To reiterate, routine activity theory posits that the opportunity for crime arises when a motivated offender meets a suitable target in the absence of a capable guardian (Cohen and Felson, 1979). Crime pattern theory explains how offenders become aware of those crime opportunities (Brantingham and Brantingham, 1981), while the rational choice perspective focuses on the guiding principle of offenders' decision making on whether to commit a particular crime or not in a given situation (Clarke and Cornish, 1985). Clearly, there is an overlap among these theories – the central point of convergence being that, as Felson and Clarke (1998) argue, “*opportunity is the root cause of crime*” (p.v). Needless to say, it is this line of thinking that underlies the general hypothesis of situational crime prevention and control in the environmental criminology literature – that reducing the opportunity for crime

reduces the risk of victimisation. Consequently, places that provide more crime opportunities will have higher risk of victimisation.

Two theoretical assumptions are central to the perspective of opportunity theories (Miethe and Meier, 1990). First, the routine activities of societies create a criminal opportunity structure by influencing the likely convergence of potential offenders and suitable targets. Second, the perceived value of a target and its level of guardianship inform an offender's choice of victim. Based on these assumptions, they proposed the "*structural-choice*" model that includes four theoretical concepts in which the perspective of opportunity theories is assumed to operationalize (see: Meithe and Meier, 1990: p.245). Each concept will be discussed in more detail below, but these theoretical concepts (or components) include: proximity to crime, exposure to crime, target attractiveness, and guardianship. Under the structural-choice model, proximity and exposure to crime represent the structural components while attractiveness and guardianship represent choice components.

On the one hand, structural components are assumed to pattern the nature of social interaction that presumably will influence the risk of victimisation. On the other, the choice components are assumed to determine which target is selected for victimisation. Although these

theoretical components are described differently across studies, Meier and Miethe (1993) suggest that they are essentially the same. Following Miethe and Meier (1990) and in keeping with more recent studies concerned with risk of burglary victimisation (for example: Miethe and McDonald, 1993; Tseloni et al., 2004; Tseloni, 2006), the conceptual framework of structural-choice model is used in this chapter. The description of the four theoretical components of this model and how they are assumed to operate under the perspective of opportunity theories is presented below.

Proximity to crime

Proximity to crime, which is assumed to increase the risk of victimisation, refers to the physical distance between a potential target and motivated offenders (Miethe and Meier, 1990; Meier and Miethe, 1993). This is consistent with the perspective of crime pattern theory (Brantingham and Brantingham, 1981) that motivated offenders will become aware of the crime opportunities “close to the central places (nodes) in their lives” such as their homes, workplace, residence of relatives, or where they socialize (Brantingham and Brantingham, 1995: p.10).

In theory, burglars are more likely to select targets close to those places particularly near their homes (Johnson et al., 2007; Block and Bernasco, 2009; Townsley and Sidebottom, 2010), exploring the opportunities that they are aware of the most, a pattern known in the literature as *distance decay* (see: Gabor and Gottheil, 1984; Hesseling, 1992). Consequently, residential dwellings closer to where offenders live, or are more likely to be found, are expected to have an elevated risk of victimisation than those located elsewhere. Empirical research conducted in Euro–American settings has provided support for this proposition using both direct and proxy measures (for example see: Bernasco and Nieuwbeerta, 2005; Vandivier et al., 2015).

Meier and Miethe (1993) suggest that the rate of offending in the immediate vicinity of a potential target is the ideal single estimate of the proximity to crime. For instance, all else equal, the vulnerability of dwellings to burglary victimisation is found to be higher for households in high crime areas, near to places that are assumed to attract many offenders (Tseloni et al., 2004), or those near to households that have recently been burgled (Johnson and Bowers, 2004). In the wake of a residential burglary for instance, Johnson and Bowers (2004) found that nearby homes (within 300 – 400m) were at an elevated risk of victimisation for a period of one to

two months. The analysis of crimes detected by the police indicated that this was explained by the same offender(s) expeditiously victimising other nearby homes (Bernasco, 2008; Johnson et al., 2009).

Another proxy measure for proximity to crime that has been found to associate with the risk of burglary is the perceived safety within a neighbourhood (see: Sampson and Wooldredge, 1987; Massey et al., 1989; Meithe and Mierer, 1990). One possible cause of the fear of crime is previous victimisation experience, or knowledge of a crime nearby (Skogan, 1986). Places with high rates of crime, presumably where potential offenders are more likely to be found, are areas where residents will perceive being unsafe the most. Regardless of whether victimisation is direct (being the victim) or indirect (knowing the victim), prior studies have found previous experience (including residential burglary) to elevate the level of being fearful, causing residents to feel unsafe (for example see: Skogan and Maxfield, 1981; Covengton and Taylor, 1991; Tseloni and Zarafonitou, 2008). Although it is important to note that actual risk is not the only thing that affects the perception of risk.

However measured, the underlying assumption is that those who reside closer to where motivated offenders live, or are more likely to

be found, have an elevated risk of victimisation. In the context of Nigeria, and perhaps other countries in the developing world, most of these measures of proximity to crime so far mentioned are straightforward to estimate. In this current study, it would have been ideal to include direct measurements of the distance between potential crime targets and where offenders live. Unfortunately, such data were not available. Consequently, two variables are used to estimate the proximity to crime – rate of offending around the vicinity of each residential dwelling, and residents' perception of safety at street segment level.

As discussed above, it is assumed here that residential dwellings located in high crime areas, presumably places (close to) where offenders live, will have a higher risk of victimisation compare to other areas. It is also assumed here that residents who are more fearful of victimisation are likely living in a high crime area. Hence, these residents will have an elevated risk of victimisation.

Hypothesis 1: Proximity to crime area is positively associated with the risk of victimisation.

Exposure to crime

Exposure to crime refers to the visibility and accessibility of a potential target, which from the perspective of opportunity theories, is hypothesized to increase the risk of victimisation (Miethe and Meirer, 1990; Meirer and Miethe, 1993). Brantingham and Brantingham (1993b) suggest that offenders will become aware of (and likely target) crime opportunities near their “*travel path between major routine activity nodes*” (p.5). As discussed in Chapter 2, one reason for this is that offenders cannot target victims of which they are not aware. Another is that awareness reduces uncertainty about the likely risks and rewards of targeting a particular location. In the context of residential burglary, dwellings that are highly accessible, relative to those that are not, are assumed to be more exposed to crime, and to thus have an elevated risk of victimisation. The assumption is that dwellings that are more accessible will allow visitors (and passers-by alike), among which are motivated offenders, to become aware of the crime opportunities in such places. Hence, this will make such dwellings highly vulnerable to burglary.

Exposure to crime has been measured differently in prior studies conducted in Euro-American settings, largely using variables related to building design, where dwellings are located within the

environment, or occupancy status of households. For example, the number of entry points into a property, assumed to represent exposure to crime, has been found to increase the vulnerability of a dwelling to burglary victimisation (Maguire and Bennett, 1982; Osborn and Tseloni 1998). Other measures of exposure to crime that are found to increase the risk of burglary include the type of housing – e.g. detached or semi-detached houses are found to have higher victimisation risk relative to terraced homes (Osborn and Tseloni 1998; Tseloni et al., 2004), although the reverse has also been found (see: Vandeviver et al., 2015), and the interaction between housing type and risk of victimisation is influenced by the area in which a dwelling is located (Bowers et al., 2005).

The characteristics of the street network have also been found to affect the vulnerability of dwellings to burglary risk – dwellings located on a major road (and those streets connected to it) have been found to have an elevated risk of burglary relative to those located on cul-de-sacs (Armitage, 2007; Johnson and Bowers, 2010), for instance. Similarly, all else equal, homes located on roads with the highest estimated usage tend to experience the highest risk of burglary (Davies and Johnson, 2015). Prior studies have also demonstrated that the pattern of occupancy in a dwelling, for example the number of days in a week or number of hours in a day

(or night) that a home is left empty can increase the risk of burglary victimisation (Miethe and Meier, 1990; Garofalo and Clark, 1992; Miethe and McDonald, 1993; Rountree and Land, 2000).

Regardless of how exposure to crime is measured, decades of research suggest that dwellings with higher exposure, relative to those with less, experience a higher risk of victimisation. To test this hypothesis in the current study, four variables were used to estimate the influence of different aspects of exposure – the distance of a dwelling from a major road, external light in a dwelling, period living at current address, and the number of families in a household. The mechanisms in which these variables are thought to influence the risk of victimisation are discussed below.

In the context of Nigeria, it is assumed that residential dwellings located on or close to a major road will have a higher risk of victimisation. Major roads are the paths that connect all the neighbourhoods and also the routes for local public transport. In contrast to cities across Europe and America, there are no fixed bus stops along the bus routes. Instead, buses can stop at any point along the route to pick or drop passengers. Additionally, major public facilities such as shopping areas, markets, and schools are located along this type of road. It is expected that, as these roads are

used as paths for daily commutes of all kinds of activities, potential offenders will become more aware of the crime opportunities offered at dwellings located on or close to these roads than those located further away.

Fixing external light(s) in a dwelling has been considered in prior studies as a source of physical guardianship (e.g. Tseloni et al., 2004). Here, however, it is assumed to be a source of exposure to crime. The reason is that, in Nigeria, the supply of electricity (from the National grid to homes) is only intermittent. Consequently, only those who can afford to install (and fuel) standby generator sets or other alternative sources of power would have uninterrupted supply of electricity. This means that external lights are not always functional in all homes. Interestingly, of those dwellings with standby generators which would ordinarily be expected to put their lights on during the night, only a few will do (majority will choose not to). The reason is that, as I discovered through anecdotal interviews, putting the external lights on during the night when others around a dwelling are without electricity is believed to draw the attention of potential burglars who will presume such dwellings are well to do and will therefore possess valuable goods.

Residential stability is another measure of exposure to crime considered in this current study. At the neighbourhood level, when considering the framework of social disorganization theory, however, residential stability is one exogenous source of social control and is hypothesized to have negative association with rates of crime (see Chapter 5). At the household level, from the perspective of opportunity theories, however, residential stability is assumed here to increase the risk of victimisation. The practice in Nigeria (particularly in places like Kaduna) is that people do not lock their homes during the day and the cultural norm is that neighbours who know each other and who have lived in the same area for a very long period (especially those below the age of 18) can enter each other's homes without seeking permission – as if they are family members. Such neighbours may include potential offenders who will become aware of the opportunities on offer. Where residents have only briefly lived in an area, they are unlikely to know as many of their neighbours or people in the area. As such, it is assumed that potential offenders will be more likely to become aware of – and have access to – crime opportunities in residential dwellings that occupants have lived in for some time, thus, exposing them to crime. The number of families living at the same address influences the risk of victimisation through similar mechanism.

To some extent though, the number of families living at the same address could be a dimension of guardianship, in the sense that households with more people (especially adults) will provide better social guardianship (e.g. Miethe and Meier, 1990; Osborn and Tseloni, 1998; Tseloni et al., 2004). However, this is not always the case. For instance, in a recent study concerned with burglary in Malawi (a country in Sub-Saharan Africa), a test of this variable (number of adult in a household) as a dimension of guardianship contradicts expectation. The finding conflicts the theoretical assumption that households with more (fewer) adults provide better (less) guardianship (Sidebottom, 2013). Instead, the reverse was found to be true and the author concluded that – “*the number of adults in a household is positively associated with burglary risk*” (p.188). As such, the number of families living at the same address shall rather be assumed here as another source of exposure to crime. Many visitors for instance, which may only be related to one family, would enter a cohabited dwelling. Such visitors may include potential offenders who will become aware of the opportunities that exist within the dwelling. This will increase the exposure of such cohabited dwelling to crime, and, thus, increases the risk of victimisation. The number of families living at the same address was therefore considered here as a dimension of exposure to crime.

Exposure to crime, like other aspects of the crime opportunity structure, can be estimated in several ways. However, it is important at this point to note that certain estimates can measure different things in different context. Considering the data that is available to this current study, the variables described above will better estimate the effect of the theoretical component that exposure to crime is assumed to have.

Hypothesis 2: Exposure to crime is positively associated with the risk of victimisation.

Target attractiveness

Target attractiveness refers to an offender's perception of the value of a crime target or its utility. As detailed in Chapter 2, from the rational choice perspective (Clarke and Cornish, 1985; Cornish and Clarke, 1986), offenders think and act rationally in the sense that they select targets that will yield the maximum perceived benefit. In the context of acquisitive crime such as residential burglary, offenders are more likely to target households that they perceive to offer more valuable goods and also with less effort and risk of being caught. All things being equal, therefore, it is assumed that potential offenders will be attracted to residential dwellings with

more valuable goods, thus, such dwellings will have a higher risk of victimisation (Miethe and Meier, 1990).

Various estimates of target attractiveness have been considered in prior studies – the foremost is the average household income or the value of residential dwelling, and this has often been found to be positively associated with risk of burglary victimisation (for example see: Miethe and McDowall, 1993; Tseloni et al., 2004; Tseloni, 2006). For instance, Tseloni (2006) finds that, all else being equal, the risk of household crime (including burglary and theft) increases by around 20% for households with an annual income of above £30,000 compared to those who earn less. However, while this finding is consistent with other UK studies (e.g. Bowers et al., 2005), the reverse has also been found in the US (see Tseloni et al, 2004). As Tseloni (2006) suggest, one explanation is that affluent households living in poor neighbourhoods will have a greater risk of victimisation – this is uncommon in the US – residential segregation based on income is higher in the US compared to Europe.

Other estimates of target attractiveness considered in prior studies conducted in Euro–American settings are concerned with the ownership of valuable goods. Meier and Miethe (1993) suggest that rarely do offenders know the household income of a potential target.

Instead, they estimate this through the valuable goods a household is likely to, or can be observed to possess. For instance, a higher percentage of home ownership in a neighbourhood (Bernasco and Luykx, 2003) and car ownership (Tseloni, 2006) have all been considered as measures of target attractiveness and are found to be positively associated with risk of burglary.

However measured, the component of target attractiveness aims to estimate the level of affluence of particular targets. Ideally, household income or the value of a dwelling would be used to estimate this construct. However, information regarding this is not available in the current study. Therefore, two other proxies of target attractiveness are employed – the type of housing (drive-in housing or not) and material used in the construction of the dwelling (built with cement or not).

Drive-in residential property is usually more expensive to construct, maintain, and rent. It is assumed that this type of dwelling will house the affluent population who will normally possess more valuable goods. For example, this type of dwelling has a private parking area which is considered necessary for most car owners in Nigeria. In contrast to cities in Europe for instance, where road-side parking during the night is commonplace (and relatively safe), car

owners in Nigeria would typically require a secured parking area to reduce the risk of becoming victims of automobile crimes. Those who live in a drive-in house are assumed to have a car which indicates a level of affluence.

Regarding the type of building material as an estimate of affluence, cement is the standard construction material in Nigeria. As noted in Chapter 5, the use of other materials such as mud is a matter of means not choice. It is therefore assumed here that residents of properties that are constructed using cement, compared to others, will have more valuable possessions, thus, attracting more property crime offenders.

Hypothesis 3: Target attractiveness is positively associated with the risk of victimisation.

Guardianship

Guardianship directly influences the protection afforded to a potential target from motivated offenders. As hypothesized by the routine activity theory (Cohen and Felson, 1979), the absence of a capable guardian eases the encounter between a motivated offender and a potential target. The concept of guardianship is operationalized in the literature using two broad dimensions (Meier

and Miethe, 1993; Tseloni et al., 2004). First, social guardianship in the form of natural surveillance – this ensues from the presence of persons willing to act to prevent crime. Second, physical guardianship refers to any form of device or security measure that is capable of preventing crime (e.g. burglar alarm).

Guardianship is assumed to alter the criminal opportunity structure. It is assumed that motivated offenders will avoid targets that are well guarded, for instance, those under surveillance (Maguire and Bennett, 1982; Bennett and Wright, 1984) or with adequate security measures (Cromwell et al, 1991). Prior studies have tested this hypothesis using different estimates of guardianship, and those concerned with residential burglary have often found that there is a negative association between some form of guardianship and the risk of victimisation (see for example: Miethe & Meier, 1990; Tseloni et al., 2004; Wilcox et. al, 2007; Reynald, 2009), although other studies have found the opposite (for example see: Tseloni and Farrell, 2002).

The estimates of social guardianship that are found to decrease the risk of burglary victimisation in Euro–American literature include: household composition such as the number of adults living in a dwelling (Miethe and Meier, 1990; Osborn and Tseloni, 1998; Tseloni

et al., 2004), the proportion of household members in fulltime employment or education (Miethe et al. 1987), and lengthy periods of unoccupancy (Hough, 1984; Garofalo and Clarke, 1992).

Physical guardianship measures, such as the presence of dog in a home or a burglar alarm, have been found to decrease the risk of victimisation in majority of studies (Cromwell et al, 1991; Garofalo and Clarke, 1992; Cromwell et al., 1999). In a review of the perceptions of burglars in the US, Cromwell et al. (1991) concluded that the risk of victimisation reduces when security measures (physical guardianship) are put in place. For instance, burglars agreed that, all things equal, they will prefer places that have no burglar alarms or where there are dogs – in fact, one general rule is *“to bypass a house with a dog – any dog”* (p.294).

However, it is important to also note that in a more recent study, Tseloni et al. (2004) found that households with security measures *“suffer more burglary than those without”* (p.85), although they issued a caution that this finding does not questioned the effectiveness of security devices – perhaps it is an indication that security measures were installed in response to a burglary incident. Underestimation of the effect of security measures is common in criminological research when the period of intervention is not taken

into account (whether a security measure was in anticipation or in response to a crime incident), a form of bias known in the literature as *endogeneity problem* (Nagin, 1998).

However guardianship is measured, the underlying assumption is that better guarded or protected dwellings will have lower risk of victimisation. In this current study, five separate variables were used to estimate social and physical guardianship. Social guardianship is measured as the rate of females in fulltime employment, and the perception of residents on whether a neighbour would act on their behalf. The physical guardianship variables considered here are whether a dwelling has a private guard, security bars, and a dog. The mechanism in which these variables are thought to operate are discussed below

It is assumed that households with more female members in fulltime employment will have an increased risk of crime victimisation. The role of female members in a typical household, particularly in the northern part of Nigeria (where the study area is located), is what some will refer to as fulltime house wives. Women are not often in fulltime employment – the tradition dictates that men are fully responsible for working and providing for all family members while women stay at home to undertake domestic responsibilities.

Although the attitude towards female employment is gradually changing across Nigeria (the percentage of females in the labour force changed from 34% in 1990 to around 43% in 2014), the data collected during the household and crime victimisation survey suggests that it is still largely the norm in Kaduna. As reported in Chapter 3, around 58.71% of households have no adult female member in fulltime employment (see Table 3.20) compared to only 3.68% in the case of male members (see Table 3.19). Additionally, even if a woman is unemployed, she will rarely socialise with friends outside of home. In contrast, men spend much of their time outside of home even if they are unemployed (e.g. socialising with friends). It is therefore expected that households without females in fulltime employment will have additional social guardianship relative to those that have. The other assumption regarding social guardianship is that neighbours are a source of natural surveillance. If they are willing to act on behalf of others when they notice suspicious activities (becoming social guardian), such action is expected to reduce the risk of victimisation.

Regarding the physical guardianship, the presence of a security guard in a property is considered a direct form of guardianship. In Nigeria, those who can afford to hire private security guards to secure their properties do so. Such dwellings are expected to have a

reduced risk of victimisation. It is also assumed that properties with security bars (a target hardening element), compared to those without, are less at risk of victimisation. Security bars usually take the form of sharp iron, barbed wire, or broken bottles placed at the top of the fence to prevent burglars from breaking-in. This form of guardianship is therefore not expected to obstruct the process of domestic theft in the sense that the crime does not require any force entering.

Regarding the presence of a dog as physical guardian, in contrast to Europe and America where people usually keep ‘friendly’ dogs at home as pets, in Nigeria, people mostly keep “*aggressive and dangerous dogs*” to prevent potential offenders from breaking into their property (Okonkwo, 2014). Such dogs will usually raise an alarm, or perhaps, attack an intruder (an unfamiliar person) who tries to enter a property. It is assumed here that dogs provide direct guardianship in residential dwellings.

Hypothesis 4 guardian in a dwelling will have a negative association with the risk of victimisation

6.2 Measurement of variables

Dependent Variable

The dependent variable is a binary measure regarding victimisation experience (*Yes* = 1, *No* = 0) asked during the household and crime victimisation survey (see Chapter 3). Specifically, the question asked was: *In the LAST 1 YEAR, have any of the following incidents HAPPENED within your property?* The response regarding two crime types, B&E and domestic theft, were used in the analyses that follow.

Independent Variables

All of the independent variables used are organized according to the four theoretical concepts described above. Where possible, the variables used in prior studies conducted in Euro–American cities are considered here.

1. *Proximity to crime:* the assumption here is that motivated offenders will become more aware of the crime opportunities that are nearer to where they live or engaged in their day-to-day routine activities, and consequently, such places will have higher risk of crime. In the current study, proximity to crime areas is measured using two separate variables including:

a) Rate of offending: to compute this variable, a buffer zone with a 500m radius was created around each residential dwelling in the sample as illustrated in Figure 6.1. This distance threshold allows having enough data points for analysis, and it has been used in prior studies (e.g. Block and Bernasco, 2009).

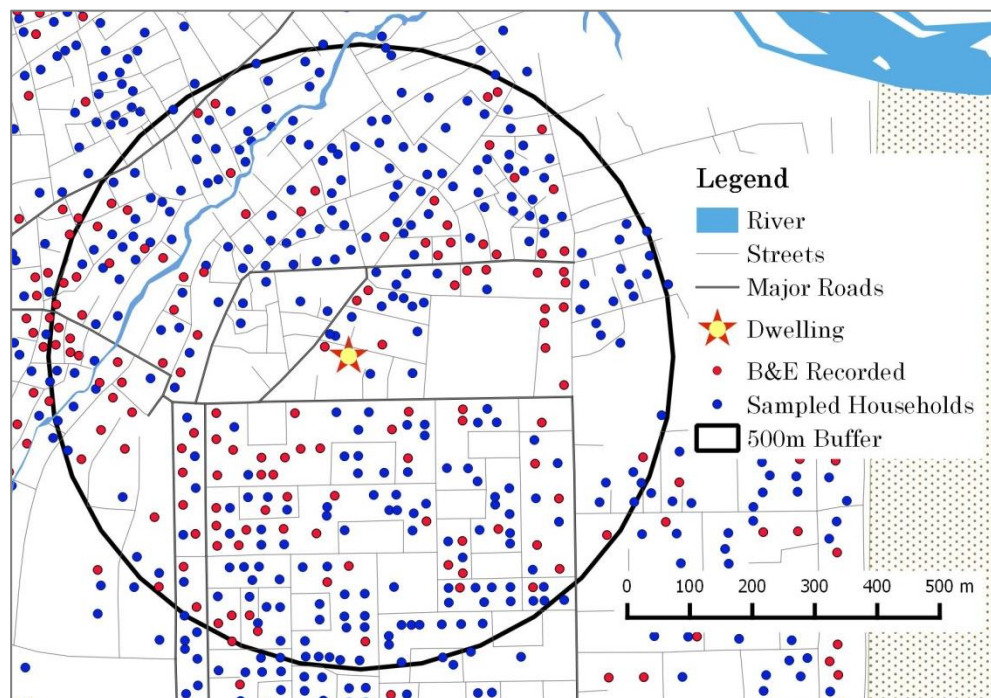


Figure 6.1: Households within 500m Buffer

For each dwelling, the number of households sampled (and offences as reported in the victimisation survey) within the buffer zone was counted. The rate of offending (B&E and domestic theft treated separately) around each dwelling (within 500m) was then computed as follows:

$$\text{Rate of offending} = \frac{\text{Total offences}}{\text{Total sample}} \times 100$$

b) Perception of safety: this variable was derived from a question asked during the household and crime victimisation survey concerned with respondents' perception of safety. Specifically, respondents were asked – *How safe do you feel living on this street?* The responses ranged from 1 (*“Extremely safe”*) – 5 (*“Not safe at all”*).

2. *Exposure to crime*: it is assumed here that dwellings that are more accessible to offenders will have an elevated risk of victimisation. Four measures of exposure to crime are considered in this study. These are:

a) Distance from a major road: to compute this variable, the distance between each property and the closest major road was calculated using the Hub Distance tool within the MMGIS plug-in in QGIS 2.12. The tool computes the Ellipsoidal distance between each origin (residential dwelling) and the closest destination (major road).

- b) External light: this variable is drawn from the BEI exercise and measured using a binary scale – whether external lights are fixed in a property (a score of 1) or not (a score of 0).
- c) Living at the same address: this variable is drawn from the household and crime victimisation survey, measured using binary scale where stable residency (living at the same address for more than five years) are assigned a value of 1 while others are assigned a value of 0.
- d) Number of families: this variable is derived from the household and crime victimisation survey. The number of households in a dwelling varied from 0 – 6 families.

3. *Target attractiveness*: two measures of target attractiveness were considered in the current study, each of which represent an indicator of affluence. Affluent dwellings are assumed to attract more property crime offenders due to the increased rewards that they are likely to be perceived to offer. These two variables are drawn from the data collected during the BEI exercise. They are:

a) Drive-in housing: this is measured using a binary scale where drive-in houses are assigned a value of 1 while others are assigned a value of 0.

b) Construction material: this variable is measured using a binary scale, where properties built with cement are assigned a value of 1 while others are assigned a value of 0.

4. *Guardianship*: five separate variables are used as measures of guardianship – two (a and b) are measures of social guardianship while three (c, d, and e) are measures of physical guardianship. The variables measuring social guardianship are drawn from the household and crime victimisation survey while the others are drawn from the BEI exercise:

a) Female employment rate: this variable is computed as the percentage of female adults living in each household that are in full time employment.

b) Neighbours' action: to measure this, a question was asked during the household and crime victimisation survey whether respondents agree (or disagree) with the following statement:
People in this street can be relied upon to act when someone is

acting suspiciously. Responses were coded by assigning a value of 1 (*strongly agree*) – 5 (*strongly disagree*).

- c) Security guard: this form of guardianship is measured using a binary scale – whether a property has a security guard (Yes = 1) or not (No = 0).
- d) Security bars: this variable is also measured using a binary scale where 1 (and 0) is assigned to properties with (and without) security bars.
- e) Dog: this variable is measured using a binary scale as well – dwellings with (assigned 1) and without dogs (assigned 0).

6.3 Results

Descriptive statistics for the dependent and independent variables are presented in Table 6.1. It shows that not all households reported being victims of the domestic theft (32.8%) and even fewer reported being victims of B&E (15.6%).

Table 6.1: Descriptive statistics for the dependent and independent variables – related to households

Variables	Min	Max	Mean	Std Dev.
Dependent Variables				
Breaking and entering	0	1	0.156	0.363
Domestic Theft	0	1	0.328	0.470
Proximity to crime				
Rate of B&E	0	108	29.83	16.92
Rate of domestic theft	8.7	213	85.81	29.86
Perception of safety	1	5	2.04	0.816
Exposure to crime				
Distance from major road (m)	0	420	120.46	89.17
External light	0	1	0.481	0.500
Living at address	0	1	0.692	0.462
Number of families	0	6	1.69	1.467
Target attractiveness				
Drive-in dwelling	0	1	0.529	0.500
Construction material	0	1	0.901	0.300
Guardianship				
Female employment rate	0	100	20.51	30.47
Neighbours action	1	5	1.817	0.704
Security Guard	0	1	0.069	0.255
Burglary-proof	0	1	0.231	0.421
Dogs	0	1	0.019	0.137

To test the stated hypotheses, a binary logistic regression (BLR) model was used for each crime type. The use of this modelling approach, as Britt and Weisburd (2010) acknowledged, is very common in criminological research where the outcome variable is

dichotomous (i.e. two expected outcomes – e.g. yes/no, crime/no crime, arrested/not arrested). All analyses were conducted using SPSS v.22 Statistical software. Regression coefficients are expressed as odds ratios which are used to interpret the result. The use of odds ratios for interpretation is simple. In this current study, odds ratios of greater (less) than 1 indicate that a unit increase in the independent variable increases (decreases) the risk of victimisation. A value of 1 indicates that an independent variable has no effect in the model. Variables that are statistically significant will have a *p*-value of ≤ 0.05 .

One key assumption of the logistic regression model is that all predictor variables are independent of each other, meaning that multicollinearity is not a problem (Menard, 2002). To test for the violation of this assumption, inflation factors (VIF) were computed for each variable to test whether multicollinearity was likely to be a problem. The VIF values for all 13 variables included in the models were less than 2 – ranging from 1.034 to 1.302 (see Table 6.2). This indicates that the variables are highly independent (see Chapter 5 for an elaborate discussion on VIF). The odds ratios from the BLR models, which indicate the effect of each independent variable in the models, are presented in Table 6.2.

Table 6.2: Odds ratios from Binary Logistic Regression models of domestic theft and breaking & entering

Variables	Domestic Theft	Breaking & Entering	VIF
Constant	0.025***	0.019***	
Proximity to crime			
Rate of Crime	1.011***	1.028***	1.104
Perception of safety	1.420***	1.262***	1.104
Exposure to crime			
Distance from major road	0.999*	0.998*	1.053
External light	1.198*	1.284*	1.119
Time living at address	1.427***	1.355*	1.044
Number of families	1.130***	1.094**	1.068
Target attractiveness			
Drive-in dwelling	0.981 ^{0.835}	1.388**	1.302
Construction material	1.464*	0.904 ^{0.575}	1.138
Guardianship			
Female employment rate	1.001 ^{0.449}	1.004*	1.034
Neighbours action	1.357***	1.280**	1.097
Security guard	0.779 ^{0.176}	0.819 ^{0.413}	1.111
Security bars	0.905 ^{0.359}	0.717*	1.180
Dogs	1.897*	0.480 ^{0.065}	1.035

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (all other p -values shown as exact values)

Domestic Theft

For domestic theft (which does not involve forced entry to a property), all but two (of the thirteen) coefficients were in the expected direction, and of those, nine were found to be statistically

significant. Considering the effect of each theoretical (structural) component of the model, the coefficients that measure proximity and exposure to crime are all in the expected direction and statistically significant ($p\text{-value} = <0.05$). In contrast, the direction (and significance) of coefficients of the choice components, target attractiveness and guardianship, are mixed. One measure of target attractiveness was in the right direction (and significant) but the other was not (and insignificant). Four out of the five variables that measured different components of guardianship were in the right direction, and of those, only one was statistically significant.

Considering the effect of structural components, regarding the proximity to crime measures, the rate of victimisation around the vicinity of a dwelling increases the estimated risk of victimisation by around 1.1%. A unit increase in the perception of safety increases the estimated risk of victimisation by around 50%. Regarding exposure to crime components, all else equal, the estimated risk of victimisation increases by 0.1% for dwellings near a major road while it increases by 21% if a dwelling has external light. The estimated risk increases by 37% for residents living at the same address for more than five years, and by 14% as number of families living at the same address increases. Put together, the structural

component, proximity and exposure to crime, increase the risk of domestic theft victimisation.

Turning to the choice components, regarding the effect of target attractiveness, the coefficient for the variable *construction with cement* increases the estimated risk of victimisation by 46% while that of *drive-in dwelling* had no significant effect. Three out of five variables that were included in the model to measure the effect of guardianship had no significant relationship with the risk of victimisation, while the other two provide mixed support for the hypothesis tested. The variable that measured the neighbours' willingness to act in the event they notice a suspicious act around their dwelling was associated with a higher estimated risk of victimisation (36%). In contrast to expectation, keeping a dog in a dwelling was associated with an increase in estimated risk of victimisation of about 90%.

Breaking & Entering

Considering the effect of each theoretical component of the model, the direction of all coefficients concerned with the structural components, measures of proximity and exposure to crime, is consistent with expectation and also statistically significant.

Regarding the choice components, the direction of coefficient for one variable concerned with target attractiveness is consistent with expectation and statistically significant while the other is inconsistent and insignificant. The model outcomes for the guardianship component are more consistent – the direction of all 5 coefficients is in line with expectation, three coefficients are statistically significant, and one is only marginally non-significant ($p\text{-value} = 0.065$). Only one coefficient failed to approach statistical significance.

For the variables concerned with proximity to crime, the rate of crime in the vicinity of dwelling increases the estimated risk of victimisation by only 3%. The perception of safety increases the estimated risk of victimisation by 26%. Regarding the exposure to crime component, distance from a major road increases the estimated risk by only 0.2%. Having external lights in a dwelling increases the estimated risk of victimisation by 28%, and living in the same address for more than five years increases the estimated risk by 36%. Cohabitation (more than one family living in the same household) increases the estimated risk of victimisation by 9%. However measured, both the structural components, proximity and exposure to crime, were associated with an increase in the estimated risk of B&E.

Regarding the measures of target attractiveness, the estimated risk of B&E increases by 39% for those living in a drive-in property but no significant association was found between living in a property constructed with cement and risk of victimisation. Considering the effects of guardianship measures, living in a household with more females in the labour force increases the estimated risk of B&E by 4% and increases risk by 28% if neighbours are unlikely to act if they notice suspicious activities around a dwelling. Relative to homes without security bars, the risk of B&E was found to be 27% lower in those with them. Although marginally insignificant ($p\text{-value} = 0.065$), keeping a dog in a dwelling was associated with a decrease in the estimated risk of B&E by 52%, while no significant relation was found between having a security guard in a property and the risk of B&E.

6.4 Discussion

In this chapter, BLR models are applied to estimate the risk of victimisation for two property-based crimes in the city of Kaduna. The hypotheses tested are based on the theoretical assumptions of the opportunity theories. Specifically, the framework of the structural-choice approach is utilized (see: Miethe and Meier, 1990).

The development of opportunity theories, however, is largely based on the experiences of cities in the developed world (particularly those in the US and UK). But, as highlighted throughout this thesis, both the social and physical settings of cities in Nigeria, and perhaps other developing countries, differ greatly to those in the developed world. The question thus remains as to whether the same findings will apply in such settings. Further, given contextual differences, careful consideration of local conditions is necessary to understand the ways in which crime opportunities manifest in these environments. This section reflects on such considerations, how they have been addressed and what the findings presented here mean for the broader literature and the criminological tradition.

Considering the local conditions first, relating to factors that influence the risk of victimisation, it is important to note that some independent variables will measure different aspect of the crime opportunity structure in different context. For instance, fixing an external (outdoor) light in a dwelling is assumed (and often found) in prior studies conducted in Euro–American settings to be a security measure which is expected to reduce the risk of victimisation (Cromwell et al., 1991; Garofalo and Clarke, 1992; Cromwell et al., 1999). However, as discussed in this chapter, anecdotal evidence (see above) suggests that residents believe that functional external lights

may attract the attention of potential offenders, rather than deter them. As such, in the context of Nigeria, this variable is assumed to measure exposure to crime.

Similarly, the number of families (more adults) in a dwelling is often assumed to provide social guardianship. However, the contrary has been found even in the Euro–American literature (e.g. Tseloni, 2006). In the context of Nigeria, one possibility is that visitors to such cohabited dwellings, some of which are presumably motivated offenders, will become aware of the opportunities on offer, and perhaps take them. Moreover, as discussed above, unlike many other countries, in Nigeria, the tradition allows neighbours to access each other's homes without permission or being challenged. As a result, relative to many other countries, in Nigeria, it is assumed that potential offenders may be more likely to become aware of crime opportunities, and to have more opportunity to exploit them (unchallenged). A similar mechanism might also explain the association between residential stability at the household level and the risk of crime. That is, the longer people live in an area, the more likely it is that more people will have access to their home, and hence that – all else equal – their home will be exposed to victimisation risk.

Turning to the findings presented in this chapter, regarding the risk of victimisation, the variables that measure the structural components of the domestic theft and B&E models, proximity and exposure to crime, were both consistent with expectation and statistically significant. That is, proximity and exposure to crime was found to be positively associated with the risk of victimisation. In contrast, the findings regarding the effect of the choice components, target attractiveness and guardianship, were mixed. For instance, target attractiveness, measured as drive-in housing, shows strong effect for the B&E model (and also statistically significant) but contradicts the expectation for domestic theft model (and is not significant). Interestingly, the reverse is the case when measured as dwelling constructed with cement – shows strong effect (and significant) for the domestic theft model but contradicts expectation (and not significant) for the B&E model.

One possible explanation is that the estimate for drive-in housing is a better indicator of affluence. To explain, not all dwellings constructed of cement are drive-in housing but all drive-in housing are constructed with cement (and also expected to have a car). The two crime types involve different tasks in that domestic theft involves less effort and requires the home to be unlocked in some way, whereas B&E requires an offender to forcefully gain access to a

home. As such, assuming two homes are equal aside from building construction, if both are left open, the construction materials may encourage theft by signalling wealth. They are likely to discourage B&E where the home is secured though since breaking in is likely to be more difficult – a thought that is consistent with the rational choice perspective (Clarke and Cornish, 1985).

With the exception of the neighbours' willingness to act variable, the findings regarding guardianship components for both the domestic theft and B&E crimes were mixed – not all variables provide support for the assumptions of opportunity theories. For instance, the presence of a security guard had no significant effect on either type of crime. This is surprising, particularly with regards to the B&E crime which requires offenders to break-in. However, it is worth noting that around 83% of juvenile offenders in Lagos-Nigeria (Ebbe, 1989) are house-servants. A house servant is one who is employed to live within a household to provide domestic help (e.g. doing some errands, cleaning, gardening etc.). This is common across Nigeria. Therefore, it is possible that most offenders are insiders – people known to the guards (e.g. house servants, neighbours etc.), and whose presence does not raise any suspicion, meaning that their actions will go unnoticed.

The rate of female employment was found to be unrelated to the risk of domestic theft, but associated with the risk of B&E crime. Again, the nature of the two crime types could explain this difference. Domestic theft does not require the offender to break into a property – so, the presence of a person at home increases the likelihood of doors being open. In fact, it could be argued that this will facilitate domestic theft in the sense that when someone is at home, a house will remain open until late evening (as discussed in Chapter 3). In the case of B&E, which does not require doors or other entry points to be unlocked, when females are away from the home, guardianship is likely to be lower.

Unsurprisingly, security bars decrease the risk of B&E crime but has no effect in the domestic theft model – such security measure will only obstruct the process of B&E crime but not domestic theft. One interesting finding with regards to the physical guardianship is the effect of keeping a dog in a house. On the one hand, keeping a dog greatly reduces the risk of B&E crime, although the effect is marginally insignificant ($p\text{-value} = 0.065$). As the threshold of $p\text{-values}$ is arbitrary, other studies might consider such an effect (a value of <0.10) as statistically significant (e.g. Miethe and Meier, 1990). On the other, keeping a dog is found to greatly increase the risk of domestic theft crime. Perhaps the explanation regarding

possibility of insiders offending applies here. A dog might not raise any alarm when the offender lives in the house or is a familiar face. Taking the guardianship components together, the two social guardianship estimates (female employment rate and neighbours' willingness to act) are most consistent with expectation, although it is also understandable that the estimates for physical guardianship will have no (or less) effect for the domestic theft crime. Another general explanation is that security measures are perhaps installed at the wake of victimisation, known in the literature as the victim effect (Mayhew, 1984).

Finally, the findings presented in this chapter provide much support for the theoretical assumptions of the opportunity theories. This in part reflects the usefulness of appropriate assumptions regarding which variable estimates what theoretical component. The results are more consistent than if you interpret them naively. Looking at B&E crime for instance, the results appear largely in line with theory, as long as you consider context when you interpret the variables. It is hoped that future research will benefit from contextualizing theoretical assumptions in this manner. It is important, however, to note that the analysis presented in this chapter is based on binary data. Put differently, the pattern of repeat victimisation remains unexplored. It is therefore intended, as

part of the proposed future work, to explore patterns of repeat victimisation using a count model. The intention is to examine the characteristics of households that are associated with repeat burglary victimisation.

Chapter 7

General Discussion and Conclusion

The aim of this chapter is not to present a detailed discussion of the findings reported in this thesis, as detailed discussions were included in each of the empirical chapters. Instead, the aim is to summarise the major findings and draw some final conclusions. The chapter begins with a summary of the findings from each empirical study (Chapter 4 – 6) and what they might mean for theory and practice. The section that follows provides a discussion of the potential limitations of these case studies in terms of how the data and approaches used might impact upon the findings. The next section highlights potential avenues for further research, and then a final conclusion is drawn in terms of what the work reported in this

thesis suggests for research concerned with spatial patterns of urban crime in the developing world and the wider criminological enterprise.

To recapitulate on the main idea of this thesis, it is concerned with the spatial distribution of urban crime – breaking & entering (B&E) and domestic theft – in a developing country, Nigeria. Specifically, the key question to be addressed was *how well can mainstream Euro–American theories of urban crime explain the spatial distribution of crime in the context of Nigeria?* In pursuit of this goal, micro–level data for Badarawa–Malali urban district of Kaduna were used to test hypotheses regarding whether the law of crime concentration at places applies in the context of Nigeria and if the main theoretical perspectives in environmental criminology can explain variations in the rates of urban crime at different spatial scales.

7.1 Summary of Findings

The environmental criminology approach has been widely employed to study patterns of urban crime in Euro–American settings. The research reported in this thesis is the first to use this approach in

the setting of Nigeria. To operationalize the theoretical frameworks of environmental criminology in such setting, theoretical assumptions were contextualised to reflect the local condition within which the research was conducted. The three case studies reported in this thesis are summarized below:

Case Study 1: Crime Concentration at Places

It is now generally accepted that crime concentrates spatially. In fact arguing for the contrary seems indefensible. However, bulk of the research concerned with the concentration of crime at places has been focused on Euro–American cities – little is known of the patterns in developing countries (particularly those in sub–Saharan Africa) such as Nigeria. This chapter reported the first study to examine the concentration of crime at places in the context of Nigeria. Hypotheses were tested regarding whether crime concentrates at different spatial scales (i.e. households, street segments and neighbourhoods), and if such clustering reflects anything other than mere chance. In contrast to prior studies conducted in Euro–American settings and elsewhere, it is worth noting that this study used data from a crime victimisation survey instead of police incident reports, which are typically used in studies of this kind.

At the household level, the findings are consistent with prior studies conducted in Euro–American cities (e.g. Sherman et al., 1989; Johnson, 2010) that crime is concentrated more than would be expected. Further analysis at other spatial scales (i.e. street segments and neighbourhoods) revealed that crime was also clustered at other levels of aggregation. At the neighbourhood level (meso–level of place), while the analyses demonstrated significant clustering, it was also apparent that this was in part explained by clustering observed at the street segment level (micro–level of place), supporting the conclusions of prior studies conducted in Euro–American settings that micro geographic units are key to understanding the patterns of urban crime (e.g. Andresen and Malleson, 2011; Steenbeck and Weisburd, 2015). It is also the conclusion of this study that the law of crime concentration at places (Weisburd, 2015) applies universally or at least in the context of Nigeria, regardless of the type of data analysed.

These findings have the potential to inform crime prevention and control efforts in Nigeria. Considering the fact that crime reduction resources are scarce, hotspots policing strategies may represent one effective way of utilising limited resources in the context of Nigeria. Such strategies allow police to focus their efforts on particular areas

where crime concentrates, an approach that has been shown to be effective in other countries (see Braga et al, 2014). Of course, what works in one country may not work elsewhere as context matters (Johnson et al., 2015), but such approaches would seem to represent a logical approach to crime control in Nigeria. Although it is important, however, to emphasize the need to address some practical challenges that may affect the effective implementation of hotspot policing in the settings of Nigeria. These challenges range from the lack of police data to consistently identify and monitor hotspot locations to the inadequacy of policing resources (including police officers and patrol vehicles) for the effective patrol of identified hotspots.

Case Study 2: Testing Theories of Social Disorganisation in Nigeria

The social disorganisation approach (Shaw and McKay, 1942; Sampson and Groves, 1989) to understanding between-area variations in rates of crime has guided a substantial criminological research enterprise. However, much of this has been conducted in settings of Western Europe and North America (particularly the US). In this case study, the likely utility of such an approach in explaining rates of crime at the neighbourhood level was considered in the context of Nigeria. Theoretical assumptions were carefully

considered to reflect the socio-cultural settings of the local environment. For example, racial diversity is commonly used in prior studies as a traditional estimate of ethnic heterogeneity – itself an indicator of social diversity. As was discussed, this estimate is of less value in the context of Nigeria as the population is almost entirely of one race. Instead, tribal origin was used to better capture the theoretical concept that ethnic heterogeneity represents. Another issue that was addressed in this study concerns the unit of analysis. Rather than using existing administrative boundaries (as studies usually do), neighbourhood boundaries were created to closely reflect what Harvey Zorbaugh refers to as natural areas (see: Zorbaugh [1926] in Lin and Mele, 2005: p.85).

The findings of this study provide only limited support for theories of social disorganisation. For both B&E and domestic theft, of the five measures of community's social disorganization tested, a reliable association was observed for only one variable. Other studies conducted in Euro-American cities (e.g. Sun et al., 2004; Bruinsma et al., 2013) and elsewhere (e.g. Breetzke 2010; Pereira et al., 2016) have also reported only partial support for theories of social disorganisation. The conclusion of this study is that social disorganisation theory, which was originally developed to explain the between-area variations in rates of crime across urban

neighbourhoods in the settings of 1940's Chicago, does not apply universally and its application requires careful thought in different contexts.

Case Study 3: Opportunity Theories and the Risk of Victimisation

This case study utilised the theoretical framework of opportunity theories to explain variation in the risk of victimisation across individual households. To date, this approach has largely been developed and applied in settings of Euro–American cities. Specifically, in this study, the structural choice modelling approach of Miethe and Meier (1990) was applied to explore whether particular characteristics of places are associated with an elevated risk of victimisation. Giving the contextual differences between settings of Nigeria and Euro–American cities, this study ensured that theoretical assumptions of the opportunity theories of crime reflected the local conditions within which opportunities for crime are assumed to manifest. For instance, some of the factors that would be assumed to reduce the risk of victimisation in prior studies conducted elsewhere (e.g. external lights), were considered to represent risk factors in the current study.

The results for both B&E and domestic theft were largely consistent with expectations of opportunity theories of crime – characteristics of households were found to be associated with risk of victimisation. This study provides strong support for the premise of opportunity theories. Although it is important to note that it was only when the local contexts were considered that results were largely consistent with theoretical expectations. Nevertheless, it was concluded that the theoretical framework of this approach applies in the context of Nigeria. This implies that crime control and prevention can be realised in Nigeria through situational crime prevention strategies (Clarke, 1980; Clarke, 1983; Cornish and Clarke, 2003) or crime prevention through environmental design (Jeffery, 1971; Newman, 1972; Moffat, 1983; Crowe, 2000). The effectiveness of these approaches has been reported in prior studies conducted in Euro–American settings (Clarke, 1997; Cozen et al., 2005). Again, what works in one country may not work elsewhere as context matters (Johnson et al., 2015), but future crime prevention policies in Nigeria can still benefit from the findings reported in this Chapter.

7.2 Limitations of the research

Environmental criminology research of the scale reported in this thesis would ordinarily rely on secondary data sources (e.g. police incident report, census data etc). This research relied entirely upon primary data that provided the precision required for micro-level analyses of crime, overcoming a notable shortcoming of secondary data. While there are clear advantages to taking this approach, however, a general criticism is that it is expensive and time consuming. Considering the funds available and distance to the study site, a strategy adopted to curtail this limitation was to collect more data than perhaps would be required to undertake this PhD project. This ensured that no additional fieldwork was required in the event of unforeseen changes to the research idea. As this research was carried out within a stipulated timeframe, the analyses presented in this thesis do not exhaust the possibilities that the data afford, thus, future work is planned to use the available data.

While addressing the issue of the *dark figure of crime* (Maguire, 2007), a term for describing under-reporting or undiscovered crimes, primary data collection method has been criticised for issues associated with accuracy of responses (Levine, 1976). For instance, a respondent might over-report crime. This source of error result

from, among other factors, memory failure about when crime actually occurred. As discussed in Chapter 3, this concern was minimised during the fieldwork through standard techniques. For example, the enumerators made reference to popular events when asking respondents about their experience of victimisation. Another source of bias that may occur is when a respondent deliberately exaggerates or out-rightly fabricates the occurrence of a crime event. Such error is difficult to control for and detect and could result to inflated rates of crime that might influence the outcome of the analyses reported in this thesis.

Another shortcoming of the primary data used here is that, in the study of crime concentration at places, the scope of the analyses is limited to a period of one year. This does not allow for the analysis of stability of crime over a longer period of time which is the norm in crime and place literature. However, other studies have also been limited to one or two years period (Weisburd and Amram, 2014; Mazeika and Kumar, 2016).

The lack of some data has also limited the scope of this research to particular line of inquiry. Considering the approaches employed in this thesis, regarding the test of Euro–American theories of crime in settings of Nigeria, there are certainly other ways in which the

analyses can be improved if other data were available. For instance, the original social disorganization theory model (Shaw and McKay, 1942) was concerned with explaining offender rates across neighbourhoods. Although the analyses presented in this thesis are concerned with rates of crime, they could be extended to cover rate of offending if such data were available. Perhaps a different outcome would have been observed if offender rates were to be included in the social disorganisation models. Other data that could improve the analyses reported here include the estimates of socio-economic status such as direct measures of income and housing prices.

7.3 Implication for Crime Prevention

The overarching objective of this research was to test whether the theoretical framework of Euro-American theories of crime could explain the spatial patterns of urban crime in Nigeria. The desired goal was to understand what characteristics of places are associated with an elevated risk of victimisation. The findings presented in this thesis, however, have some practical implications for crime prevention. Specifically, these findings have the potential to inform the implementation of situational crime prevention measures in Nigeria. The idea of situational crime prevention is that crime could

be reduced through the alteration of situational factors (Clark, 1983; Cornish and Clark, 2003).

In light of the patterns of victimisation found in this research, that characteristics of some certain places increase the opportunity for crime and consequently elevate the risk of victimisation, crime prevention efforts in Nigeria should consider the formulation and implementation of situational crime prevention strategies. In doing so, the strategies must be crime-specific, as opportunities for each category of crime are dissimilar (see: Clark, 1997). Additionally, since opportunities for crime are structured within small areas (see: Brantingham and Brantingham, 1981; Johnson et al., 2007), such strategies should be directed at micro-places.

7.3 Future Work

The findings presented in this thesis have provided new insights into spatial patterns of urban crime in a developing country. As discussed in each empirical chapter of this thesis, new research questions have emerged that can advance the research started here. This section aims to suggest avenues for further research.

Considering the chapter on crime concentration at places, the analysis was limited to only two crime types – breaking and entering and domestic theft. It is possible that different patterns will be observed for other forms of offending, although a recent study has suggested that, regardless of the type of crime analysed, crime will spatially concentrate at few micro places (Andresen et al., 2016). Nonetheless, future research might explore this. Another issue that was not possible to explore here, concerns the spatial stability of crime over a long period of time. Survey data are not ideal for addressing such research questions. The use of police recorded data, should it become available in Nigeria, would allow such analyses in the future.

The findings reported in Chapter 5 are largely inconsistent with theoretical expectations. One possible explanation is that the estimates of the various components of social organization theory considered in the analysis failed to capture the constructs they sought to estimate. Alternatively, perhaps other local area conditions, other than (or in addition to) those originally conceived, would better explain the processes of social (dis)organization in settings like Nigeria, and, thus, account for the between–area variations in the rates of crime. Future studies should focus on more precise measures of community social disorganisation such as the

use of income to measure the level of socio-economic status of communities and also consider the distribution of offenders instead of crime, which might lead to different conclusions. Studies can also employ other methods such as the systematic social observation (Reiss, 1971) to generate data about social interactions within communities and physical conditions of the environment (see Sampson and Raudenbush, 1999).

The findings reported in Chapter 6 provide much support for the premise of opportunity theories of crime. This can be advanced in some ways. For instance, the approach taken was to consider the influence of risk factors at the individual household level. As such, the analysis did not consider area level factors (except for measure of proximity to crime and rate of offending within the immediate environment of a dwelling) that might influence the crime opportunity structure. Future studies of crime in Nigeria should consider the use of multilevel modelling approaches to account for both household and area level influences in the crime opportunity structure. This approach has been employed not only in prior studies conducted in settings of Euro-America (Sampson et al, 1997; Tseloni, 2006) but also in others such as sub-Saharan Africa (Sidebottom, 2013). It is therefore intended, as part of the proposed future work, to integrate the theoretical assumptions of social

disorganization and opportunity theories. In doing so, a negative binomial model that takes into account the rate of repeat victimisation will be considered rather than the binary model utilised in Chapter 6.

7.4 Thesis Conclusion

This thesis sought to address a key research question regarding whether theories developed to explain patterns of crime in Euro–American settings have any utility for explaining patterns in other settings, specifically Nigeria. Using the frameworks of the environmental criminology perspective in particular, this thesis has provided evidence to suggest that, to an extent, patterns of crime in Kaduna Nigeria are consistent with theoretical expectations of the Euro–American theories of crime. Precisely, strong evidence was found to support the premise of the law of crime concentration at places and the opportunity theories of crime while limited support was found for theories of social disorganisation. This thesis demonstrates the possibilities of employing the theoretical frameworks of environmental criminology to explore spatial patterns of urban crime in understudied regions such as sub–Saharan Africa.

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Appendix A: Block Environmental Inventory (BEI) Form

BLOCK ENVIRONMENTAL INVENTORY FORM																				Block Ref: _____						
Road		Type:	Surveillance		CCTV Camera:		Street lights:		Signs of dis-order		Graffiti:															
		Condition:			Vigilante Post:		Street gates:				Garbage:															
Traffic		Vehicular	Morning		Afternoon		Evening				Encroachment:															
		Pedestrian									Drainage:															
s/n	Ref No	Land use	Plot				Other uses				Building			Access Control & Target Hardening												
											Type		Material													
			Occupied	vacant	Abandoned	Construction	Shops	Kiosk	In-trading	Out-trading	Flat	Storey	Attached	Detached	Cement	Mud	Temporary	High walls	Burglary-proof	Gate	Garage	Outdoor sitting	Security Lights	Guards	Open Access	Danger Warning
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Appendix B: Household and Crime Victimization Survey Questionnaire

Household Interview and Crime Survey

Reference Number

This questionnaire is part of a PhD research aimed at understanding the environmental factors influencing the spatial distribution of property crime. The research project covers the whole of Badarawa, Malali, Ungwar Dosa and Kawo urban Districts of Kaduna Metropolis. The questions are designed to ascertain your experience of property crime as well as your perception of safety at this property and within this street. I hope you could spare 10 minutes to respond to the questions that follow. Thank you in advance.

Note: Any information you provide will be treated as completely confidential. Your participation is voluntary and you reserve the right to decline or opt out at any stage. I hope that you will respond to all questions as they are all extremely important to the research, but you reserve the right not to answer any question that you are not comfortable with. No reported findings will identify individuals or specific locations. All responses will be stored securely.

[] Please tick this box if you agree to voluntarily participate

Section A: Questions related to household Details

1. Are you the household head? Yes [] No []
If No, please indicate your relationship to the household head_____
2. a) Sex: Male [] Female []
b) Age: []
c) Ethnicity:_____
3. Occupation: Civil Service [] Private Organisation [] Craftsman [] Trader []
Farmer [] Student [] Retiree [] Unable to work [] Unemployed []
Others, please specify_____
4. Employment Level: Executive [] Managerial [] Expert [] Intermediate []
Trainee [] Large business proprietor [] Small business proprietor [] Others,
please specify_____
5. For how long have you lived at this address: Less than 1 year [] Between 1–
2years [] Between 2 - 5 years [] More than 5 years []
6. Tenancy type: Owner occupier [] Rented accommodation [] others, please
specify_____
7. Type of living in this address: Single Person [] Single Family [] Extended
family [] Compound Sharing []

8. Number of families living in this address: [1] [2] [3] [4] [5] [Above 5]
9. Family size: Family 1 [] Family 2 [] Family 3 [] Family 4 []
Family 5 []
10. Number of Adults living in this household: Male [] Female []
11. Employed Adults living in this household: Male [] Female []

Section B: Questions related to your relationship with neighbours and your perception of safety within this street

Note: - Properties in a street are those on both street block faces between two road intersections
- Neighbours are those people who live in the same street with you

1. How safe do you feel living on this street? Extremely safe [] Very safe []
Moderately safe [] Slightly safe [] Not safe at all []
2. How worried are you about being a target of property crime while you are away from home?
Not worried at all [] Slightly worried [] Moderately worried []
Very worried [] Extremely worried []
3. How many of your neighbours do you know? All of them [] Most of them []
Half of them [] A few of them [] None of them []
4. How strongly do you interact with your neighbours? Extremely strong [] Very strong []
Moderately strong [] Slightly strong [] No interaction at all []
5. People act with courtesy to each other in public spaces in this street. Strongly agree []
Agree [] Neither agree nor disagree [] Disagree [] Strongly disagree []
6. People in this street can be trusted. Strongly agree [] Agree [] Neither agree nor disagree []
Disagree [] Strongly disagree []
7. People in this street are willing to help their neighbours. Strongly agree []
Agree [] Neither agree nor disagree [] Disagree [] Strongly disagree []
8. People in this street can be relied upon to act when someone is acting suspiciously.
Strongly agree [] Agree [] Neither agree nor disagree [] Disagree []
Strongly disagree []
9. Your neighbours will inform you of any suspicious activity around your property.
Strongly agree [] Agree [] Neither agree nor disagree [] Disagree []
Strongly disagree []
10. How proud are you to live on this street? Extremely proud [] Very proud []
Moderately proud [] Slightly proud [] Not proud at all []

Section C: Questions related to incidents that had happened within your property

In the **LAST 1 YEAR**, have any of the following incidents **HAPPENED** within your Property?

1. Burglary (Breaking-in) - Yes [] No []
If yes, how many times? []
2. Stealing of valuables (Not breaking-in) - Yes [] No []
If yes, how many times? []
3. Deliberate damaging of your property Yes [] No []
If yes, how many times? []
4. Theft **from** Automobile Yes [] No []
If yes, how many times? []
5. Theft **of** Automobile Yes [] No []
If yes, how many times? []
6. Deliberate damaging of your automobile? Yes [] No []
If yes, how many times? []

Excluding the last 1 year, have any of the following incidents **EVER HAPPENED** within this property?

1. Burglary - Yes [] No []
If yes, how many times? []
2. Stealing of valuables - Yes [] No []
If yes, how many times? []
3. Deliberate damaging of your property Yes [] No []
If yes, how many times? []
4. Theft **from** Automobile Yes [] No []
If yes, how many times? []
5. Theft **of** Automobile Yes [] No []
If yes, how many times? []
6. Deliberate damaging of your automobile Yes [] No []
If yes, how many times? []

Section D: Questions related to incidents that had happened at your next door neighbours

In the **LAST 1 YEAR**, have any of the following incidents **happened** at your immediate next door neighbour?

Note: [R] Refers to the neighbour on the right hand side of your property as illustrated below

[L] Refers to the neighbour on the left hand side of your property as illustrated below



1. Burglary - Yes [R] [L] No [R] [L] I don't know [R] [L]
If yes, how many times? [R =] [L =]
2. Stealing of valuables - Yes [R] [L] No [R] [L] I don't know [R] [L]
If yes, how many times? [R =] [L =]
3. Deliberate damaging of your **neighbours' property** Yes [R][L] No [R] [L]
I don't know [R] [L]
If yes, how many times? [R =] [L =]
4. Theft **from** Automobile Yes [R] [L] No [R] [L] I don't know [R] [L]
If yes, how many times? [R =] [L =]
5. Theft **of** Automobile Yes [R] [L] No [R] [L] I don't know [R] [L]
If yes, how many times? [R =] [L =]
6. Deliberate damaging of your **neighbours' automobile** Yes [R] [L] No [R] [L]
I don't know [R] [L]
If yes, how many times? [R =] [L =]

Excluding the last 1 year, have any of the following incidents **EVER HAPPENED** at your next door neighbours?

1. Burglary - Yes [R] [L] No [R] [L] I don't know [R] [L]
If yes, how many times? [R =] [L =]
2. Stealing of valuables - Yes [R] [L] No [R] [L] I don't know [R] [L]

If yes, how many times? [R =] [L =]

3. Deliberate damaging of your **neighbours' property:** Yes [R] [L] No [R]
[L] I don't know [R] [L]
If yes, how many times? [R =] [L =]
4. Theft **from** Automobile Yes [R] [L] No [R] [L] I don't know [R] [L]
If yes, how many times? [R =] [L =]
5. Theft **of** Automobile Yes [R] [L] No [R] [L] I don't know [R] [L]
If yes, how many times? [R =] [L =]
6. Deliberate damaging of your **neighbours' property:** Yes [R] [L] No [R] [L]
[L] I don't know [R] [L]
If yes, how many times? [R =] [L =]

The END

Thank you for your time